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The Hematite Mines of Cumberland, England

In Mining the Large Orebodies the Caving System Is Employed with Varying Methods for Removing the Pillars and Supporting the Ground

BY LUCIUS W. MAYER*

The county of Cumberland lies on the northwest coast of England, with the counties Dumfries and Roxburgh, in Scotland, to the north, and the Irish sea to the west. In the southwestern part near the sea are the Cambrian mountains. Cumberland produces great quantities of coal and iron, its iron ore being known for its richness and low phosphorus content. The ore is a hard anhydrous peroxide of iron yielding at times almost the theoretical proportion of metallic iron although the average is nearer 50 per cent. The kidney form of hematite is very common. Less prevalent is a material called "pencil ore," which brings as much as £100 per ton and is used for ornamental purposes.

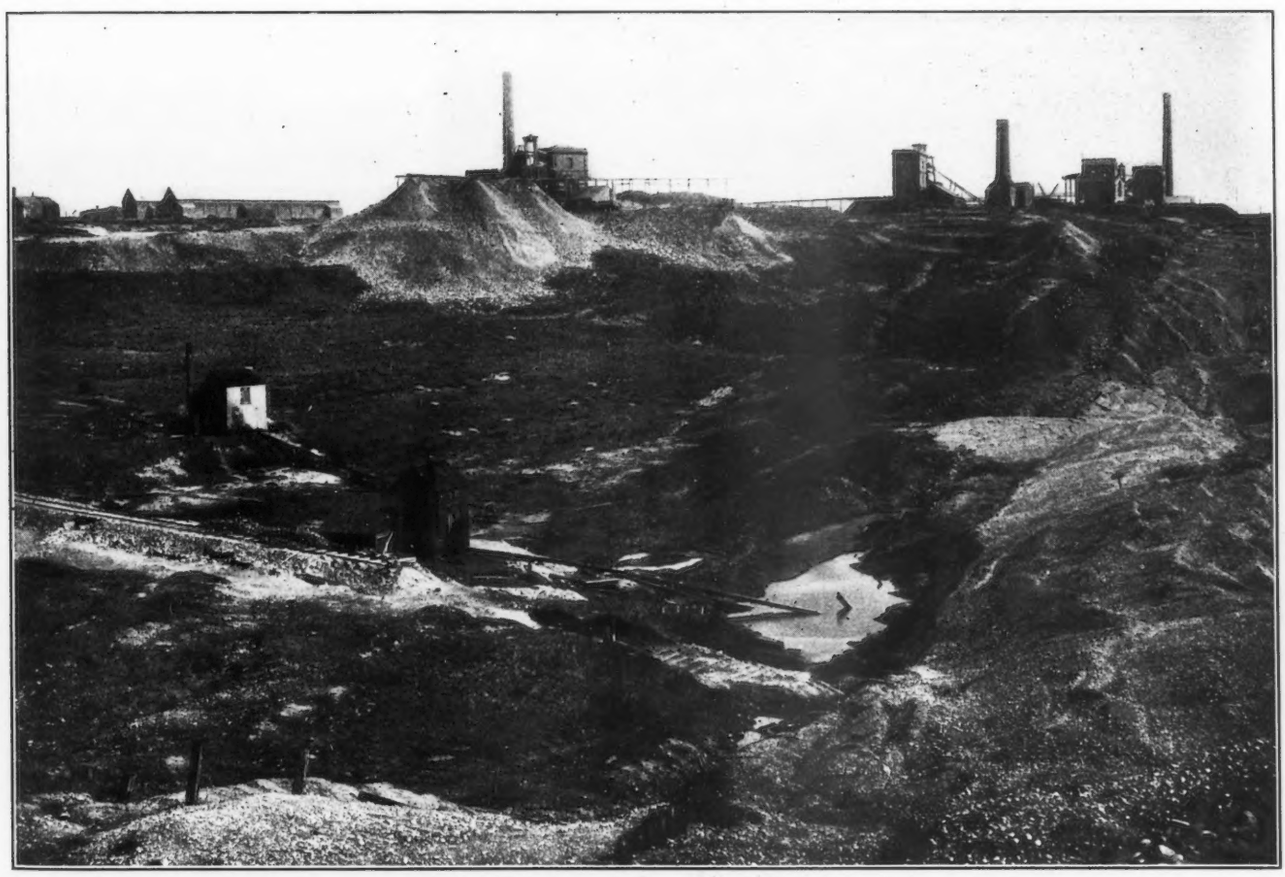
The orebodies of Cumberland appear in every conceivable form. They occur in vein-like formations, in the form of beds, and more often, in irregular masses. The region is much faulted, a majority of the faults running in a northwest-southeast direction. Blue limestone and conglomerate are usually found as a roof over the ore and the floor is commonly slate. Wherever the blue-lime belts are encountered it is well to look for iron, and where the lime horizons are absent, search usually reveals nothing.

It is in the faults that the ore has been given opportunity to deposit. The strongest faults lie in the direction noted, but the general system is crossed by innumerable minor faults. The orebodies are sometimes found in narrow veins, similar to fissure veins in appearance, pinching to nothing in places. In the bed-like deposits, a very consistent thickness is sometimes maintained over large areas. The ore brings about 17s. per ton on the basis of 50 per cent. iron.

Methods of Mining

Cumberland is essentially a caving-system country, and no miners are more skilful in conducting the work and the necessary timbering operations than the men of this district. Wherever the caving system is in use the Cumberland miner stands to the fore. He is especially in evidence in the Lake Superior district and in Utah, where the caving system is in use.

Most of the ores in the Lake Superior region are softer than the softest ores which I saw in Cumberland; and only



SHAFTS NOS. 5 AND 6, HODBARROW MINE. CAVED GROUND IN THE FOREGROUND

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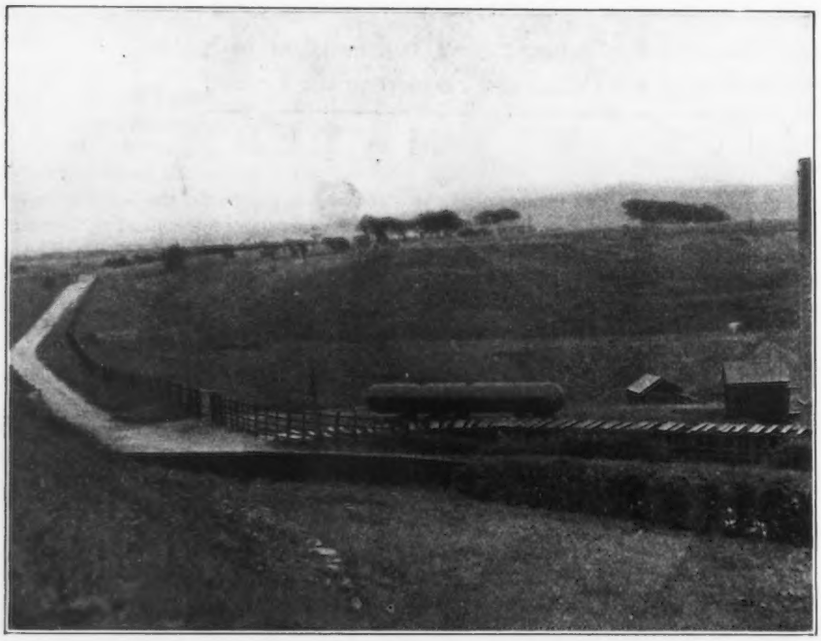
on the Menominee range have I seen ores which compare in hardness with those in Cumberland. In the Lake Superior district the caving system is used mostly on soft ores. The Cumberland ores are rather tough, thus differing from the porphyry copper ores of Utah and Nevada, where the caving system has been successfully operated.



SURFACE SUBSIDENCE, PARKSIDE MINE, CUMBERLAND

There is no very marked tendency in the ironfields of Cumberland to depart from old methods of underground work. For example, there is but one inclined shaft in the district, even though there are several deposits generally admitted to be adapted to this method of operation. This does not speak well for the initiative of the Englishman. However, the ability of the men to handle fallen ground in caving areas, makes up for provincialism in other directions.

The Cornish pump is used very generally in Cumberland; in fact, as far as I know, there are no other steam pumps employed underground in the county and few in the whole of Great Britain. The use of the direct-acting steam pumps underground is not at all favored. The opinion prevails that conveying steam underground and handling the exhaust, is no better than a nuisance, and that it is a far less favorable arrangement than the more expensive Cornish pump, and its cumbersome parts.

The air drill, it appears, has not been given a fair trial in this region. The men, although they possess considerable skill in the handling of mechanical devices, prefer to use the hand drill and jack, even in the very hardest ores. It is quite true that in some places the ore is much fractured with many vug-holes and irregularities which interfere with the efficient use of an air drill, but this condition is not so common as to bar the power drill entirely.

Parkside Mine

The Parkside mine is situated at Frizzlington, near Whitehaven, the center of the iron-mining country on the west Cumberland coast. The mine is one of the pioneer hematite producers of the district, but the ore zones are at present pretty well depleted.

SEA BARRIERS, HODBARROW MINE, CUMBERLAND

The orebody originally worked had the form of a huge wedge, as shown in section in the accompanying sketch. This body of ore dipped at a rate of one to four. The roof was sandstone and limestone, while the floor was underlaid with slate, sometimes replaced by limestone. The sandstone strata above the ore are extremely hard; but I found it hard to believe a statement that continual drilling for 18 months had only advanced a 5-in. hole 180 ft. The condition of the ground above the area from which this orebody was worked is shown in an accompanying illustration. The mine in this section is impassable, but the general method of working was as follows:

A vertical shaft was sunk outside the deposit. At 540 ft. a crosscut was driven to the ore and continued as a drift to the hanging wall. From this cross-drift, were extended lateral drifts, at 30-ft. intervals, parallel to the strike, and from these laterals, cross-drifts were cut at similar intervals, thus blocking out the ground on this level in 30-ft. squares, by 10x10-ft. drifts. At 600 ft. in the shaft, a second crosscut was driven, and similarly extended across the orebody. Similarly, from the 600-ft. level, a crosscut was started, and the work of blocking carried out as in the other level.

From the point where the crosscut intersected the orebody, a rise was started on the footwall, which, in these Cumberland deposits, is fairly regular. This rise was extended half-way to the upper level when a sub-level was started, which would be about 30 ft. higher than the level below. The bords on this level were cut the same size as on the main hoisting levels; in fact, all the work was similar on the sub-level, the only difference being that sub-levels are not directly connected to the shaft.

In blocking out it is endeavored to have the drifts in symmetry, one below the

other. The work having advanced sufficiently from the various levels as regards blocking out, rises are started from the upper level to the top of the orebody, the different levels being connected by rises, to afford air circulation. By successive slicing, the ore is brought down above the drifts. The overburden is kept separate from the ore by means of timber acting as a mat for the waste to rest upon. Simultaneously, at other points, underhand stoping may be in process of execution in drifts, until eventually the interval between the levels has been either raised, or lowered, and finally pillars 30 ft. square are formed, which extend from the hanging to the footwall.

These operations extended over a long period, and no attempt was made to remove the pillars from the mine until the entire area had been blocked out in the manner described. When it became desirable to remove the pillars and recover the ore in them it was realized that surface derangement would ensue, and that it did ensue is shown in one of the accompanying illustrations.

The method said to have been used for the removal of pillars suggests great possibilities. Going up the rise, the pillars were under-cut, and every effort was made to bring them down without attempting to remove the rock. After a shot was fired all loose ground was barred down, the roof about the pillar being constantly tested. Finally the pillar became so weak that it would crush and crumble. The men did not leave the place until it was certain that a cave was imminent. A cave finally occurring, the men waited until the ground settled, barring down loose pieces of rock by standing on the fallen ground. As this work progressed the cave became more extensive, until finally the entire country subsided.

The ground having settled means were immediately taken to recover the ore in the pillars which had caved. This ground was pierced by means of forespiling, and it is stated that these timbered drifts were driven at comparatively low cost, and were readily maintained in the broken ground.

As a result of general caving, severe contortion of the surface resulted, which not alone affected the ground immediately above the pillars but also drove the shafts out of alinement and damaged the surface plant. A common sight in this vicinity is a chimney which, having taken a tilting position due to subsidence, has been straightened up by inserting wedge-shaped bricks on one side in the base, the lower portion of the chimney making a distinct angle with the upper portion.

The areas worked today in the Parkside mine are mostly narrow veins, a few feet thick, in general steeply inclined. Wherever these bodies widen sufficiently, the usual custom is to raise in the ore, block out pillars 24 to 45 ft. long and 18 to 36 ft. wide, and then top-slice these pillars in a manner to be described later.

Creator Moor Mines

The mines of Lord Leconfield, at Creator Moor, in Cumberland, were worked as early as the 17th century. The hematite orebodies averaged about 75 ft. in thickness, dipping from 20 to 45 deg. Above the ore is a coarse sandstone, called "whirlestone," which in turn is covered by 40 to 50 ft. of clay. The footwall of the orebody is limestone.

As the ground stands today, the conditions are similar to those which obtained at Parkside, in Frizzlington, before the pillars were caved. There is simply a succession of pillars, which, in this case, are sometimes 70 ft. square, and in hight approximate the maximum of 75 to 80 feet. There is no timber to be seen in this section of the mine. The pillars stand vertical and follow the rise and fall of the floor. The rooms between the pillars are

FORESPILING THROUGH FALLEN GROUND

about 10 ft. wide. It is possible to climb over a great area in the stopes between the pillars. Where the floor undulates to a steep pitch, light chains are fixed above, so that it is quite possible to climb from the lower level of the mine to the top by following the footwall. The method of working used was similar to that at Parkside, i.e., by sub-levels and blocking out of the area, involving the final cutting out of the middlings, thus exposing four free sides of the pillar which extended from foot to hanging wall.

A Problem of Robbing without Disturbing the Surface

The problem of robbing these pillars presents requirements different from those at Parkside, for at Creator Moor it is imperative that the surface area be maintained. From the standpoint of caving, I venture to say, there would be no hesitancy in attacking the pillars, but this method is prohibited. Over certain sections of the mine, where the pillars happened to be no higher than 25 ft., surface restrictions were not important. In these places the pillars were caved, and the ore recovered. The method followed was to side-lane the pillar and bring down all roof rock. When the span between the reduced pillar and its neighbor became too great, and the roof became treacherous, the latter was shot down, the men standing on the broken rock to further test the roof, and work on the upper part of the pillar. When the fall was high, and the broken rock did not present sufficient elevation, ladders were used.

In working with the drill on ladders the miners use an interesting little scheme. A plank about 5 ft. long, is held under one of the rungs of the ladder, and two loops of a light chain are passed under the plank and around the rails of the ladder in such a manner that the plank is wedged at one end, the other end extending out as a cantilever. The plank serves as a platform from which the miners single-jack at the desired elevation.

In working this ground if the roof caved before the removal of pillar material had been completed the ore was recovered by forespiling through the broken ground. On approaching the stump of a pillar a second branch drive was sometimes started to expedite the removal of the portion left standing. The aim in the first attack is to cave the pillar, and in forespiling, to draw off the ore in the timbered drift shelter, until the waste rock makes its appearance. In forespiling a part of a pillar may be encountered in a comparatively solid condition. In this case mining will be carried on in the ordinary way with a solid face at the head of the drift. When the pillar is a large one, several roads may be driven about it, and through it, until little or no ore of value is left in the area.

The matter-of-fact way in which the miners go about these operations indicates the security which they feel in the work. They are at home in caved or caving ground; it is the ground which hangs and does not submit to control that causes anxiety and calls forth their utmost efforts to induce a fall in the desired way.

Various means of removing the tall pillars standing in the mine without incurring surface subsidence have been considered. A scheme recently outlined involves the filling of the mine with sand flushed in with water, and to pump out the water in the manner employed in Upper Silesia. In my opinion the Creator Moor company has a far more difficult problem than those generally encountered in Germany, and there are certain complications on account of the dip which increase the difficulty.

Keeping in mind the inclined stope, and the pillars standing vertical, it is apparent that the roof span between supports will be great on the removal of the pillar.

During my visit 29-ft. lengths of 5-in. steel pipes, ½ in. metal, were being hung in a 6-in. bore hole, and a complete pipe line was in process of erection in the mine.

The sand is to be hauled by a road traction engine in wagons a distance of one mile from the sand bank. The wagons are of the bottom dump type, and of four tons capacity.

Ullcoat Mine

The Ullcoat mine is situated at Ullcoat, near Whitehaven. The ore worked is generally a very hard hematite. A conglomerate roof makes its appearance more frequently here than at the other mines visited. The ore is a replacement in limestone, and the floor is a Silurian slate; the coarse conglomerate of the roof is sometimes displaced by limestone or slate. Vug-holes are frequently encountered in the formation; they vary in size, from a few inches, to caves nearly large enough for a man to enter. These vug-holes are often filled with a fine quality of pure plastic clay which is readily extracted and is put to good use.

There is the greatest irregularity in the physical condition of the rock, and this, with its hardness, has discouraged the company from giving air drills a fair trial. The drilling is all done with hammer and steel, and it is not surprising to learn that at times the hammermen are doing well when accomplishing a 2-ft. hole in eight hours' work; 8 ft. per shift is near the average. Noble powder containing 85 per cent. nitroglycerin is used in the hard ores, with a No. 6 cap and rubber-covered fuse.

There are three rectangular shafts on the property, this form being rather common in Cumberland. It is the intention to rob the pillars eventually, and the policy now being carried out in mining keeps this idea in view. It is evident that the company realizes the importance of leaving large pillars, rather than making the mistake of doing the robbing work on small pillars.

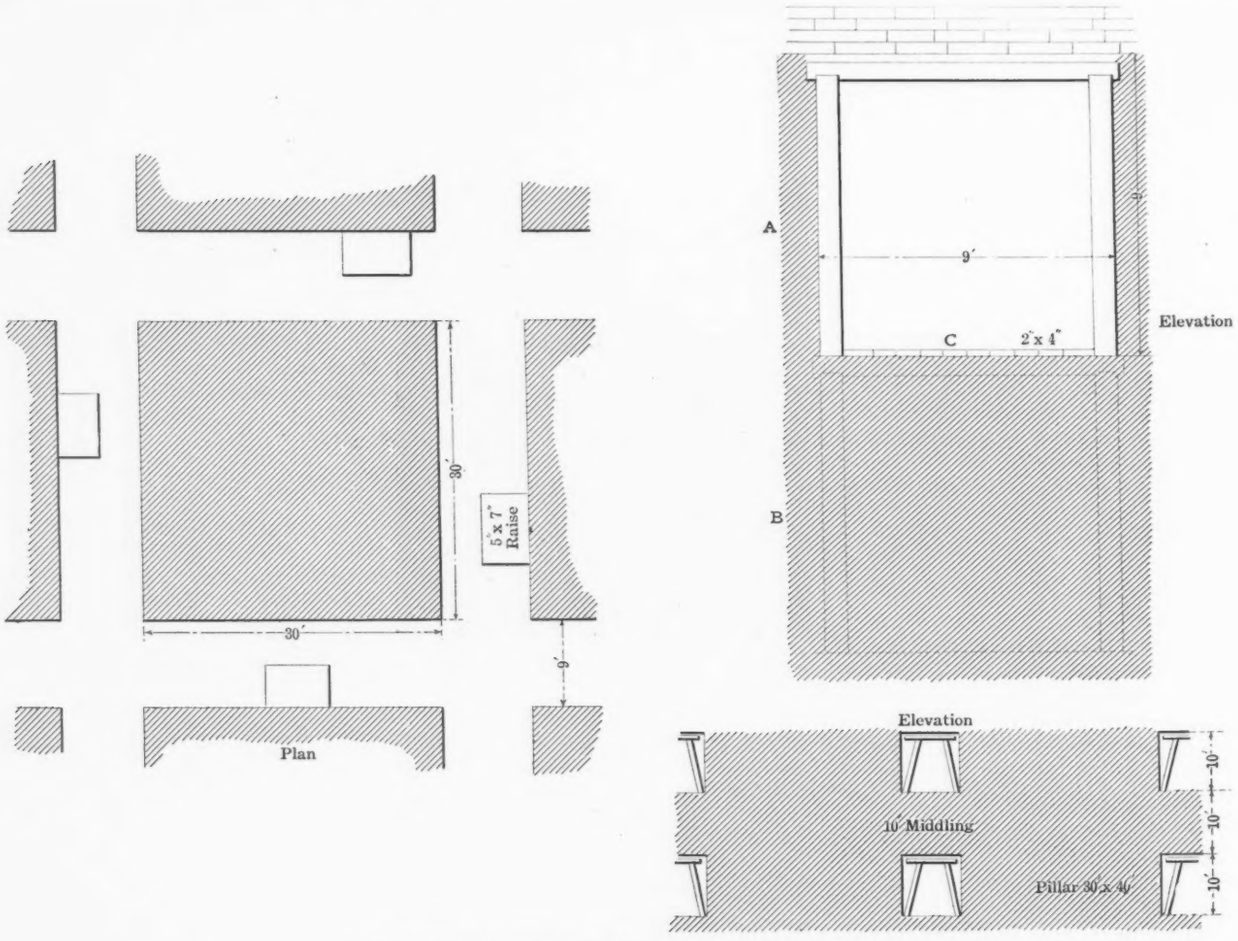
The two main shafts are 50 and 80 fathoms deep, respectively, the latter having three levels.

The peculiarity of a great many seams in this district is the nature of the outcropping materials. As the surface is approached, a very soft, loose material is encountered, which has the appearance of thoroughly wetted mortar. This condition led to a serious inrush not long ago, when the work of robbing the upper pillars was begun. The workings were filled with the soft clayey material, and great difficulty was encountered in reopening the area. A district subject to such inrushes is now bulkheaded so as to confine the incoming material to small areas.

In one seam, which averaged about 6½ ft. in thickness and had a dip of one in three, the ground was thoroughly blocked out in the upper levels by pillars 30 ft. wide and 40 ft. long. The rises, or bords, between the pillars are 10 to 12 ft. wide. Robbing has been begun in this orebody. In other parts of the mine, work is largely confined to blocking out pillars and, I am told, the large profits of this company are derived wholly from development work, which thus far has been the feature of the operations, particularly in the thick deposits.

Timber Used in Removing Pillars

The method of working after a number of pillars have been blocked out along the lines indicated is briefly as follows: The pillars nearest the outcrop are attacked first. Starting at the top of the rise of the uppermost pillar, a lane is cut about 8 to 9 ft. below the top of the pillar. As the driving of this lane is advanced, timbers are set under the outcrop, the stulls being 8 to 10 in. in diameter. In a case of this kind, where the walls are strong, the cap may have but one post under it, the other end of the cap being hitched into the wall in a recess about 8 in. deep. Similarly, on the floor of this lane, a sill may be set hitched into the wall; where it is impractical to hitch the timber, it is



METHODS OF CAVING EMPLOYED IN CUMBERLAND, ENGLAND

wedged between the walls. Over the sills of this first set, planks or round poles are set, which serve later in keeping the outcropping material separate from the ore when the overburden is lowered.

The first lane of a pillar having been completed, a second lane is immediately begun about 9 ft. below the top of the sills placed in the first lane. Before doing this, however, the upright post timbers are withdrawn so as to cause the roof over the first lane to drop, the fallen ground being waste material. The second lane is started in the same way as the first, the posts being set under the sills of the first lane, the horizontal pieces which serve as sills for the first lane becoming caps for the second. This, in general, is the principle of the caving system for all widths of vein, except in case a middling is left. In this particular instance the vein was narrow, but in wider veins the principle is practically the same, with exceptions in the details of timbering.

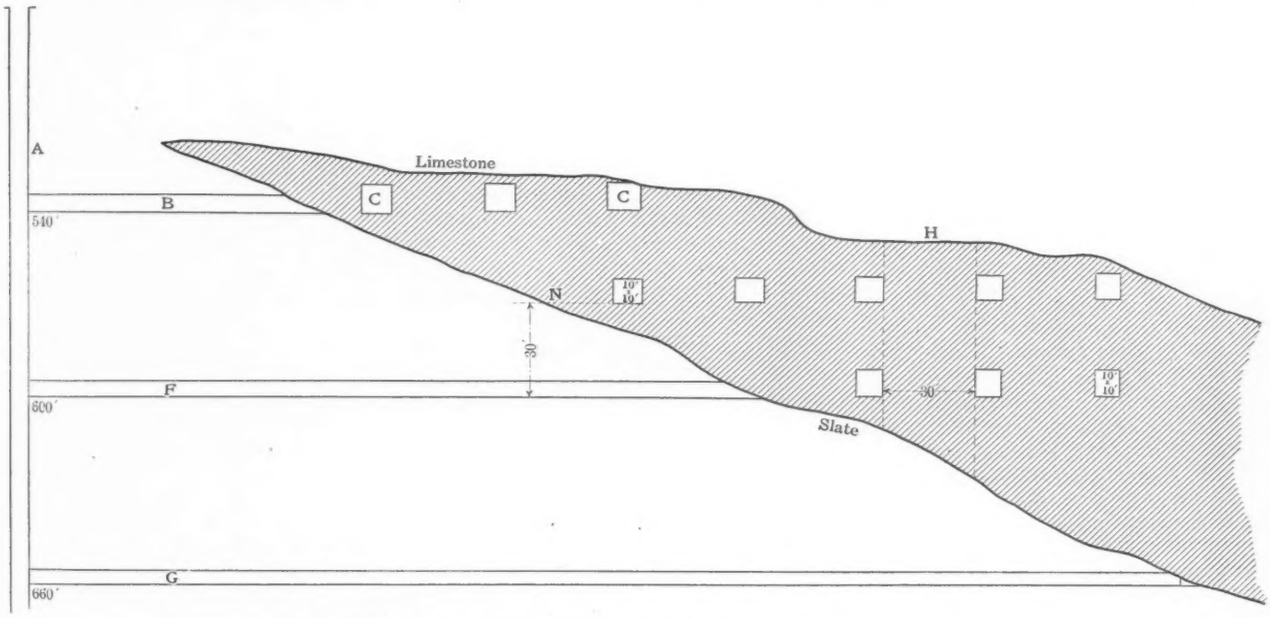
The ore is disposed of by lowering it in small cars. When several pillars are robbed simultaneously, one rise may be handling the product from two adjacent pillars, and when pillars are robbed at different points in the mine, several rises below may be equipped as main inclines down which the ore is conducted to the shaft level. The headings below each pillar may be considered sub-levels connected with the nearest hoisting level by means of the bords between the pillars.

The ore is not necessarily sent to the hoisting level in a straight line, but may be sent down a series of rises or bords which are not in the same plane, but which afford the best available route. The rises which are used for the lowering of the ore to the hoisting level are maintained more thoroughly than the others. Bad roof conditions in certain sections of the mine determine the choice of haulage location. The re-handling necessary at the foot of various sub-levels, in many cases probably overbalances the cost of maintaining the roadways in a definite straight line.

In the thick irregular deposits, which sometimes become as wide as 100 ft., the work has all been merely blocking out. This has consisted in driving headings and cross-headings 10x10 ft., with an intervening middling of 10 ft., i.e., a series of 10x10-ft. headings blocking out pillars 30x40 ft., then dropping down 20 ft. and repeating this operation. Wherever the deposit shows regularity, these headings are, if possible, kept in the same vertical plane.

Hoisting levels are usually about 60 ft. apart. From the first level raises are driven from convenient points to the top of the orebodies, and from the second level connections are made with the workings on the first in a similar manner. From the top of the raises breaking-out levels are started, and at 30-ft. intervals, sub-levels. The work of blocking out the 30x40-ft. pillars may, of course, be carried out at several levels at once, but it is well to do considerable development work first, in order that the form of the orebody may be well determined, permitting an intelligent policy to be outlined in advance.

In the irregular deposits a great variety of conditions are met, and extensions are necessarily made from time to time which, when following stringers, often lead to the discovery of new pockets.



THE OREBODY AT PARKSIDE MINE; METHOD OF WORKING LARGE DEPOSITS

Hodbarrow Mine

Hodbarrow Point lies at the extreme southern end of Cumberland, near a town called Millom, which is about a half hour's ride out of Whitehaven, and borders on a little bay of the Irish Sea. The sea plays a very important part in the mining operations of the Hodbarrow company.

The ore is a hard hematite, averaging about 57 per cent. iron, and lies in great bodies dipping slightly seaward. These bodies are as thick as 100 ft. in parts of the property, while thicknesses of 10 to 20 ft. are common. Above the ore are alternating beds of sand, blue gravel clay and a harder variety of clay, called "pinnal clay." As the deposit approaches the sea a limestone roof comes in over the ore.

Mining has been going on in this vicinity for many years, but early developments were discouraging, and Lord Lonesdale, the owner of the ground some time ago granted a lease to the Hodbarrow Mining Company, which is now mining nearly half a million tons annually. Owing to the previous condition of the strata overlying the ore, underground work presents great difficulty involving not only danger, but also considerable outlay in the endeavor to check the inrushes of sand and water.

During the eighties, a timber wall was built to hold back the sea from the surface area under which the mining operations were to be carried on. This wall was destroyed by the sea and in 1890 a masonry wall was built. Previous to the construction of this wall, the ground had been well prospected. The wall is formed of concrete blocks keyed the one into the other. Puddled clay was used to make the wall impervious to water. The structure stood until a rush of quicksand underground destroyed its foundation, when it began to subside. Following this, a policy of boring under the sea ahead of this wall was inaugurated. Diamond drilling from floats was not without its difficulties, but from the arrangement of

holes shown on the company's map, it appears that the work was done skilfully.

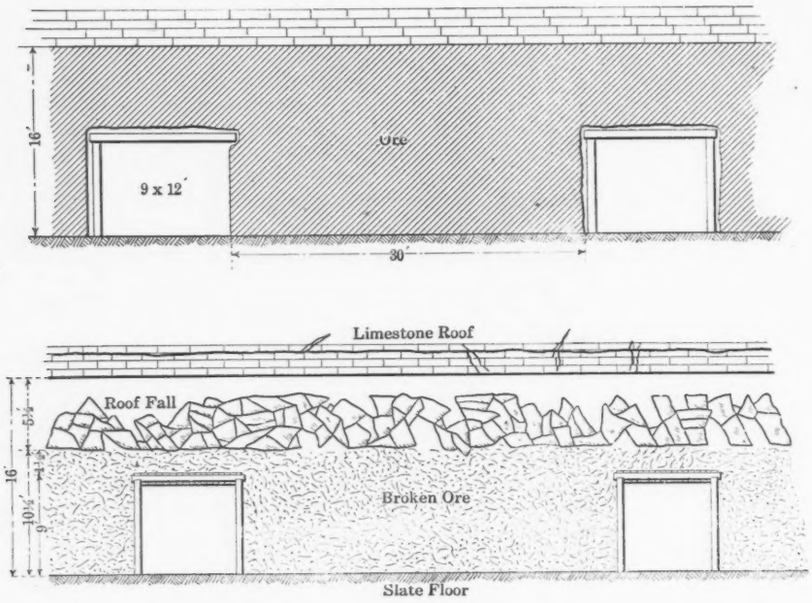
Hodbarrow Outer Barrier

A large acreage was finally outlined showing a continuation of the ore seaward, and it was decided to build another wall to hold back the Irish sea. This is the famous Hodbarrow outer barrier, built at a cost of about £500,000. A lighthouse was placed on the wall, in accordance with the stipulation of the government when rights to the area were granted.

The length of this new wall is 6870 ft. Its construction covered a period of five years. Its shape is the segment of a circle. The designers were Coode Son & Matthews, who, I understand, also built the Zambesi dam in Egypt. The area inclosed by the wall is about 170 acres of which, according to the geological maps, at least half shows ore. While it is quite certain that the ore extends farther under the sea, this will probably be the last wall the company will be permitted to build, because of Government restrictions to preserve the river channel.

The form of the wall varies to a certain extent with geological conditions of the bottom. It consists of an outer and inner limestone barrier, formed like truncated pyramids. Within these two pyramids is a wall of puddled clay to make the barrier watertight. The top of this wall is 5 ft. above high water. Where the clay bed underlying the bed was regular, the central puddled clay wall was keyed into the bottom, but where the bed was irregular and formed of coarse sand, 30-ft. sheetings of steel were driven, the result being a massive steel construction. In front of the outer limestone bank are strewn concrete blocks which weigh from 15 to 25 tons each.

One point has been borne in mind in the design of the structure, the necessity of flexibility; so that in the event of foundation subsidence, the entire structure will sink intact instead of failing by fracture as in the case of the first wall.

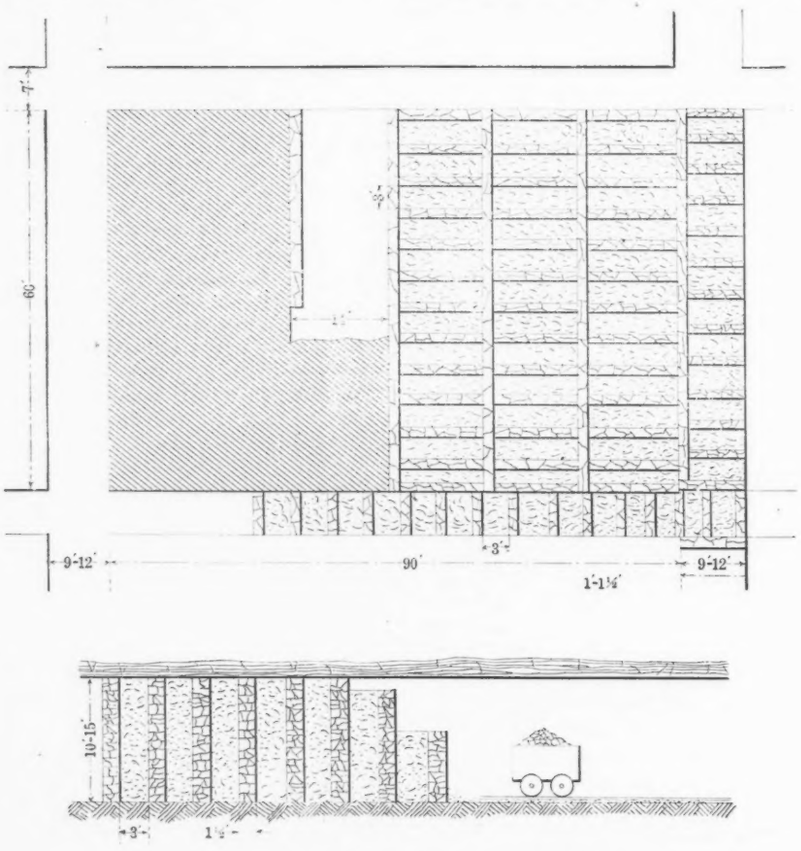


CAVING 16-FT. BED OF IRON ORE, HODBARROW MINE

mensions are cut than in the older work.

All but one of the shafts on the property were sunk in ore, and this one is quite a recent attempt to have a shaft on the property which will outlast the mining operations. The other shafts have been more or less affected by the work of mining, in spite of the fact that large pillars have been left about the pits. Considerable difficulty was encountered in shafts where sand strata were found. A telescopic method of shaft sinking was adopted, starting with a diameter of 19 ft. and tapering down to 11 ft. at 60 fathoms, the difference being due to the thickness of metal in each succeeding length of tubing.

An interesting attempt to introduce the American square-set system was made in one of the large orebodies. This immediately met with considerable favor, following as it did the radically different caving system in use up to that time. The new method worked successfully for a long time in a territory adjoining ground which had been mined out by the old system. However, as the work progressed in the new orebody, the fallen area of the old work was approached, and with insufficient side support for the timber sets, a bad creep resulted in the top-



METHOD OF PILLAR ROBBING AND FILLING AT PARK PIT

Mining Below the Sea Bed

In mining under the inclosed area of the sea, greater care is required than in work within the shore line. By the stipulation of the lease pillars of larger dipling over of the entire framework. It was then decided to attempt no further introduction of square sets, and the caving system alone has since been in use throughout these mines.

In working the deposits the ground is first systematically laid out in squares by means of drifts usually about 9 ft. square. The policy is to make the drifts as wide as consistent with roof conditions, and 9 ft. has been found to be economical in the greater part of this mine.

The method of mining varies to a certain extent at Millom, in accordance with the thickness of the ore. Where the ore is but 10 or 12 ft. thick, the system would resemble in a measure, the methods used at Cleveland, always keeping in view the eventual withdrawal of the pillars. With this thickness, the ore is taken in one lift, and where the overburden is soft, forespiling must be used in all drifts. In the ordinary landward work the pillars are blocked out 30 ft. square, but under the ground reclaimed between the two sea walls, the pillar requirement is 90 feet.

The ground being well blocked out in advance, a regular system of caving is started in the usual manner. When limits of the orebody have been reached steps are taken for caving the pillars. When the overburden is hard and blocky, no particular precaution is exercised in laying flooring to keep waste rock separate from the ore; but where the overburden is soft, 2x4-in. planks are placed on the floor upon which the roof is allowed to fall.

Short Talks on Mining Law —VIII

By A. H. Ricketts*

The United States Mining Act defines the term "placers" as including all forms of deposit excepting veins of quartz and other rock in place. It has been held by the courts that by the term "placer claim (as used in the act) is meant ground within defined boundaries, which contains mineral in its earth, sand or gravel; ground that includes valuable deposits, not in place, that is, not fixed in rock, but which are in a loose state, and may in most cases be collected by washing or amalgamating without milling," but the mode of reduction is not material. Legislation, supplemental to that act, specifically provides that land chiefly valuable for building stone (whether for business or ornamental purposes), or containing petroleum, or other mineral oils, salt springs, or deposits of salt in any form may be located under the provisions of the law in relation to placer-mining claims. Coal lands in Alaska and the Phillipine Islands are subject to special acts.

Under the decisions of the courts and the rulings of the Land Department, the following are declared subject to location as placer claims: Agate; alkaline earths; alum; aluminum; asphalt; auriferous cement (also as subject to lode location); borax; brick clay; building stone; coal; coprolites; china clay; diamonds; fahlband; fire clay; granite; gypsum; gypsum cement; guano; gold-bearing gravel; iron (also as subject to lode location); kaolin; limestone; natural gas; mica; marble; mineral-paint rock; nitrate of soda; opal; plumbago; petroleum or other mineral oils; phosphates; potash; resin; rock salt; sandstone; stockworks; sulphur; saline lands; salt springs; soda; stone suitable for making lime; slate; tailings; umber. "Valuable deposits" must be located according to the classification to which the mining act has declared and the courts have decided that they belong, but when their classification has not been so particularly determined the manner of locating, whether as a lode or a placer deposit, depends upon the form, character, and manner of occurrence of the deposit.

Whether a "valuable deposit" may be located as a lode or placer claim is determined by the form and character of the deposit or the specific requirements of the law in relation to the locating of claims.

It has been held that the law permitting placer locations is not a "catch-all system allowing parties to play fast and loose to suit their own caprice, and locators insisting upon the validity of a location by reason of a particular mineral, must show that the location was made for that purpose and no other." But it is not necessary to specify in the location notice the particular mineral upon which the location is based, as it will include all minerals found therein subject to placer location. Whether land is chiefly valuable for its minerals is a question of fact. It is not permissible to locate a mere water right as a placer claim.

"Lode claims" are those located upon veins of quartz and other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposit, whether metalliferous or non-metalliferous. The term "rock in place" as used in the mining act is synonymous with what miners call "country rock;" that is, not float nor isolated bunches, boulders of rock, debris, detritus or alluvium, but rock which is inclosed and embraced in the general fixed and immovable mass of the earth's crust. It has been held that "this term (rock in place) should be given the most liberal construction that the language will admit of, and every class of claims that according to either scientific acuracy or proper use can be classed or applied for as a vein or lode claim, can be acquired under the law;" but the vein itself may consist of loose, broken or disintegrated matter.

The Entry, as Mineral Ground, of Ground Claimed Otherwise

There must be an appropriate discovery in either class of locations to validate the claim. A placer locator is not compelled to embrace within his lines land which is unfit for mining, although within the lines of the public survey; but the discovery must be within the limits of the claim.

At any time before final entry of a homestead application the land covered thereby is subject to lode or placer location, provided entry upon the land can be made peaceably. The duty, however, devolves upon the mineral claimant to institute proper proceedings in the local land office to determine the character of the land, and to prove that the land is more valuable for mining than for agricultural purposes; otherwise the land may be patented as agricultural, notwithstanding its true character. Possibly, as the result of such hearing, the court may order a segregation survey to be made so as to divide the land into mineral and non-mineral land; each claimant then to take his respective part of the land in dispute.

It has been held that lands within an unpatented townsite may be located as mineral land, although in actual occupancy, but if application for patent has been made and final entry has been had, only land known to be mineral at the time of such application is excluded from the operation of the townsite patent. Therefore, such patent does not properly include a known mining claim.

Coal Lands

A preferential right of entry is acquired by the location of coal lands, but entry in the land office is not confined to one having such right. A location of coal land may be made upon surveyed or unsurveyed lands and, for safety, entry in the local land office should be made within 60 days after the first day of actual possession and improvement, provided the township plot has been filed already in the local land office; otherwise, 60 days after filing of the township plot. Final entry should be made within one year, but in the absence of an intervening adverse right, it may be made after that time. It is sufficient to prevent adverse homestead entry of the land if coal is developed in paying quantities.

Coal lands are not patentable under the mining act, but must be patented under a special act. Any person over 21 years of age who is a citizen of the United States may enter 160 acres, or an association or company 320 acres of land, but, if the association is composed of four or more persons and has spent not less than $5000 in working or improving the ground, it may enter not more than 640 acres. The right of entry, whether the entry is made by an individual or by an association, is exhausted with application made, although it may be for less than the maximum acreage. Hence, an association cannot exercise the right if one of its members has previously made such entry.

Oil Lands

The fact that surface indications of petroleum oil or the geological formation

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of the country may be such as scientific research and practical experience has shown to be likely to lead to petroleum oil in paying quantities, or that the land has been reported by the surveyor general as mineral in character, or that land in its vicinity is valuable for its minerals, does not serve to constitute a sufficient "discovery" within the meaning of the law, for, until the place of deposit from which the oil is drawn is discovered, the location must remain a speculative one.

Petroleum oil with its natural gas, unlike other mineral deposits, is movable by virtue of its own inherent force, as well as by virtue of its liquid character. The normal condition of petroleum oil is one of repose and not of motion, and it belongs to the rock in which it is imbedded. The mining for mineral oils or natural gas cannot be conducted as is other mining by awaiting the development of other claims of similar character.

Mining for oil is looked upon by the courts, as in the nature of the capture of wild animals. That is, from their propensity to escape, he who first has actual possession, is first in right. Hence, the possession of a petroleum-oil or natural-gas claim is a qualified one and mining thereon should, for safety, be carried on, either before or contemporaneously with similar mining by, say, adjoining owners. Otherwise there is the risk of the loss, through drainage by prior work, of mineral value in the land in which the actual work of extraction is delayed. The difficulty in the way of preventing the recovery by the owner of the petroleum oil or natural gas would be the impossibility of making the necessary proof of ownership. It may be said that the rule for the government of rights against draining percolating water does not prevail as to underground seepages or percolations of minerals oils, as such oil is not intended for agricultural purposes, and has a commercial value only to the producer.

Drilling or operating oil wells within or upon the dependable territory of a navigable river or below high tide, or on an ocean beach, or from a wharf, or within three miles of the shore, is conducted by the forbearance of the Federal and State Governments. Mining on tide lands and in navigable waters in Alaska is permitted by reason of special Congressional legislation affecting that district. Elsewhere, such operations are a technical trespass.

Hydraulic Mining

By legislative enactment in California, hydraulic mining is defined as "mining by means of the application of water under pressure through a nozzle against a natural bank."

The essentials to the practical conduct of hydraulic mining operations are these: In addition to obtaining a permit to conduct the same when required by law and compliance therewith, water must be obtained in quantities and carried to the mining ground under pressure sufficient to disintegrate and wash down the natural bank; for these purposes reservoirs, ditches, flumes and pipe lines are indispensable. The soil and gravel thus eroded must be carried, by gravity and the force of the refluent water, through cuts, sluice ways and flumes where the gold, by reason of its greater specific gravity, is deposited, caught and gathered. Lastly, by aid of the same beneficient agent, the resulting waste matter, or mining debris, as clay, sand, stones, rocks, boulders, soil and gravel, must be carried away through convenient channels so as not to impede further operations or constitute a pubic nuisance.

The hydraulic method of placer mining is not in itself unlawful, nor necessarily injurious to others, but is highly useful and commendable when properly conducted and without injury to the property or rights of others; but as the detrital matter became a menace to navigation by its deposition in navigable and unnavigable streams tributary thereto and was an interference of the rights of property of others by overflowing their lands, its continuance was practically enjoined in California in 1884. Subsequently in 1893 Congress passed what is popularly called the "Caminetti Act," or sometimes "Debris Act," by the terms of which such mining could be resumed within certain areas (San Joaquin and Sacramento river systems) in that State; the flow of detritus to be restrained by means of impounding dams built and maintained by the mine owner, and also by the Government, under regulations prescribed by a commission created by that statute. This act has been held mandatory and constitutional. It is not lawful to conduct such mining within the prescribed areas unless under permit from such commission and in compliance with its instructions. A permit given may be revoked by the commission. The courts also exercise a supervisory power in the matter and sometimes nullify the permit by enjoining the licensee from mining thereunder by determining that the impounding or restraining works erected by him are not sufficient for their intended purpose, or that no permit has been granted.

Lands subject to hydraulic mining which are without the said prescribed areas are not within the jurisdiction of the commission, but mining may be carried thereon wherever and whenever it will not result in material injury to navigable streams, or to the land adjacent thereto.

Dredge Mining

Dredge mining is another method of placer mining. It differs in a material feature from hydraulic mining, in that the waste material is deposited and left upon the land, often in the "pit" made by the dredge. Such mining is carried on in a navigable stream by the forbearance of the Federal and State Governments. The bed of such a stream is not subject to mineral location as it belongs to the State and not to the United States, although such a waterway is said to be "the property of the nation." As navigable streams are public highways, any unauthorized obstruction or interference thereon by a private individual is a public nuisance and may be enjoined. The right to mine therein cannot be acquired by custom nor by prescription.

The right to dredge the banks and nearby land may be acquired by location, if it is chiefly valuable for its minerals, and still belongs to, and is not reserved by the United States. If the land has passed into private ownership, the right to dredge must be secured by purchase or agreement from the owners. An unnavigable stream and the bed thereof within a State belongs to the United States, and generally, may be covered by a placer mining location. The location may be laid so as to include the bed of the stream and a part of one or both banks of the same and contiguous land, or so as to follow the course of the bottom of the stream. It will be sufficiently marked, in California at least, because of the absence of any statutory enactment, or possibly a local rule therein regulating the manner of location, by posting a notice of location on some object in the stream, as a stump or snag, by giving the measurements of the claim, identifying the stream and showing a definite relation between the stream and the selected object upon which the notice is posted. From this data the boundaries can be readily traced and that is all that is required by the mining act of Congress, which governs all locations not affected by local statute or rule.

Laws Applying to Mineral Land in the Philippines

The locating and patenting of mining claims in the Philippine Islands are subject to the provisions of a special (amended) act. This act adopts some of the features of the Mexican mining law, as well as some of those of the United States Mining Act, and provides for the regulation of some matters of detail which, in the latter statute, are left to regulation by local law or local rule. It provides for "square locations" not exceeding 300 m. (about 1000 ft.) in length and 300 m. in breadth, to which no extra-lateral right attaches. It requires that the claim shall be marked by two end lines and a discovery post at the point of discovery, each post to be marked in a prescribed way, and that the line between the end-line posts shall be distinctly marked. Fractional claims must be denominated as such in the record which, in all cases, must be filed within 30 days after location and have upon the back of the notice (declaration, it is called in the act) a sketch plan

showing as nearly as possible the position of the adjoining mineral claims, and the shape and size (expressed in meters) of the claim or fraction desired to be recorded. The "holder" is not entitled to more than one mineral claim on the same vein or lode. A claim may be abandoned by filing written notice thereof with the recorder.

Work or improvements worth 1000 pesos is a condition precedent to patent and the Government must be paid 25 pesos per hectare for the land embraced in the claim. Placer claims cannot exceed eight hectares for an individual claimant and 64 hectares for an association of persons, irrespective of the number of persons composing such association. Millsites are limited to two hectares. Tunnel claims, as such, are not recognized.

Coal lands may be entered by a competent person more than 21 years old to the extent of 64 hectares, or 128 hectares by an association. The Government price for the land ranges from 50 to 100 pesos, according to the situation of the land. Saline lands are subject to auction or private sale for not less than six pesos per hectare.

This act seems to foreshadow the temper of Congress in relation to ultimate changes in the United States Mining Act, which was originally passed (1866) after an opposition so determined that it bore the singular title of "An act granting the right of way to ditch and canal owners, and for other purposes," the better to conceal its purpose and insure its enactment.

Back-stoping vs. Underhand Stoping in Large Bodies of Iron Pyrites

By J. J. Rutledge*

Theoretically, in mining large bodies as uniform in nature as iron pyrites it would seem that the overhand or back-stoping method would be most economical, and yet in several large iron-pyrites mines, it has been found by experience that the best method is that of underhand stoping. A consideration of the conditions which have led to the adoption of the underhand method may not be out of place.

Ordinarily, when back-stoping has been the method of mining employed, it has been necessary to drive the drift above the stope in order to open it up and this has added to the cost of the stoping as well as delaying the rapid opening out of the stope. The usual practice is to use stulls in mines in which the walls require support and the deposit dips at a high angle, and to allow the ore and rock to fall on the stulls at the bottom of the stope, chutes being used to load the ore into the cars in the level below. By this method gravity assists in the work of mining and less powder is necessary to break the ground than in underhand stoping. The ore is separated from the rock on the stulls and the rock left to support the walls, instead of being sent to the surface.

Little labor is required to load the cars, since the chutes are always kept full of ore and the cars can be loaded almost instantly. The miners usually are close to their work and can examine the ground overhead at all times and pull down any loose pieces of ore or rock.

Disadvantages of Back-stoping

The method of back-stoping, however, usually has the following drawbacks: When a top drift and pillar are left at the top of the stope, it is necessary to hoist the stulls into place instead of lowering them, as in underhand stoping. Again the back-stope occasionally requires the shooting of rock from the walls in order to fill the stope and give the miners access to the breast. While this work is being done no ore is being produced and consequently there is no output from this particular stope. Back-stoping gives an uncertain output. There may be a stope full of ore on one day and it may require several days' labor before the chutes can be again filled.

If drills are placed on staging made usually of lagging poles, instead of being set upon the loose rock and ore in the stope, there is always vexatious delay in cutting hitches for the lagging poles, before the staging can be erected. The spring of the lagging, if long, bothers the driller and the staging often falls, endangering the lives of the driller and helper; there are often loose scales of pyrite, sometimes of considerable thickness, which must be dislodged before the staging is set up, or before any work whatever can be done in the stope, and this delay of necessity retards all other work; loose pieces of ore are found over the back of the drifts, as well as over the stopes, and become very dangerous, for they cannot easily be detected, as the ground may be solid one moment and the next a dangerous piece of ore or rock may become loosened from the backs.

All holes drilled are necessarily dry holes and must be carefully tamped and fired or there will be great danger from sulphur fumes. In addition to the foregoing the drillings fall down upon the drill and tend to shorten its life. Drillers and timbermen, especially those inexperienced, generally dislike to trim the breasts and walls of back-stopes, or to prepare for and erect the stagings, for the work is dangerous. If the stope is wet the men cannot as easily avoid the droppers as they can in underhand work.

Underhand Stoping

With this method properly employed it is only necessary to drive one drift to open up the ground, i.e., the drift on the uppermost level. All the levels below can be opened without the necessity of driving drifts, unless it is decided to leave pillars over the stopes. Under careful management the drillers, timbermen and muckers always work in safety under well-lagged stulls and, if the walls are carefully trimmed of all loose pieces and closely and constantly watched, there can be no danger from falls of ore or rock. The drillers, muckers and timbermen have all their work underfoot instead of overhead as is the case in overhand stoping and consequently the ground is constantly under inspection.

Stulls can be lowered into the hitches instead of being raised as is the case in overhand stoping. All the holes are down holes, and wet, hence the danger from sulphur fumes is nearly negligible. There is no fine ore falling upon the drill as when all holes are dry. If floor or jointing planes occur in the orebody, advantage can be taken of this fact more readily in this method than in the other one. Water falling over the underhand stope can be caught by canvas sheets or light planks and led off to the footwall.

It is true that all waste in the orebody worked is more easily handled and disposed of in overhand work than in underhand, but, by keeping well-lagged stulls close to be breast of the stope, the muckers can easily pass all waste rock up to the lagging on the bottom stulls and stow the rock at that point. There may be cases, however, in which it will be cheaper to load and hoist the rock to the surface than to pass it through the handling necessary to stow it on the bottom stulls.

Of course, mucking and tramming are usually easier and cheaper in overhand than in underhand stoping but, by placing boiler-iron plates, or a floor of heavy 3x12-in. planks at the bottom of the stope, before the shots are fired, all muck can be dropped on this flooring and thence easily shoveled into the cars. By such means, and the use of low, open-ended cars, the mucking in underhand stoping can be done nearly as easily and cheaply as in overhand stoping. By making stopes of sufficient hight and working three or more benches simultaneously, there will always be working places for the drillers and at all times a good quantity of muck at the bottom of the stope.

The underhand method gives greater safety in mining, yields a much more uniform daily output, and usually mining can be done cheaper by this system than by overhand stoping.

Tom Johnson (*Journ.* Chem., Met. and Min. Soc. of South Africa for March, 1908) states that in waste-filled stopes, when the hanging-wall of the stope gives way, the subsidence amounts to about 50 per cent. of the hight of the excavated area, and on the Rand he thinks this subsidence will travel to surface with little diminution.

*Mining engineer, Baltimore, Md.

The Ore Deposits of Magdalena, New Mexico

Hematite and Zinc Blende Are Found Associated at the Ground-water Level, Creating a Zone of Impoverishment Instead of One of Enrichment

BY PHILIP ARGALL*

Magdalena, a town of about 1200 inhabitants, is connected with the main line of the Sante Fe railroad by a branch running up from Socorro, N. M., while a spur track about three miles in length extends from Magdalena to the Graphic smelter near the village of Kelly, the heart of the mining district. Kelly is situated on the western slope of the Magdalena range at an altitude of 7500 ft. The ore deposits extend along the slope of the range both north and south from Kelly; my knowledge of them, however, is limited to the exposures in the two principal mines of the district, both lying north of the village of Kelly.

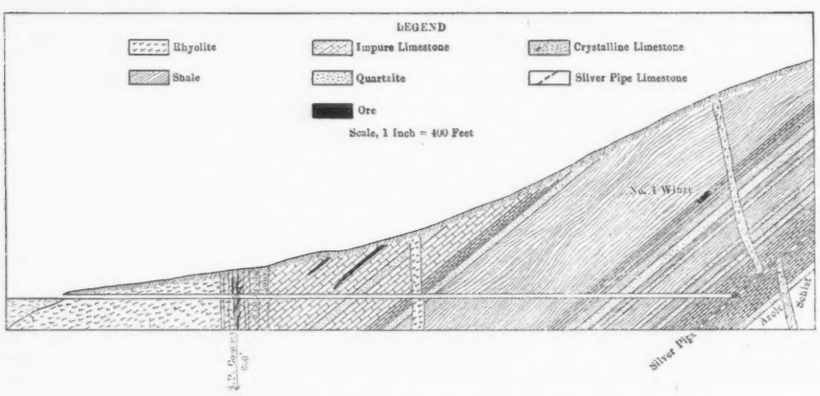

FIG. 1. SECTION OF GRAPHIC MINE THROUGH WALDO TUNNEL

Historical

The mines were first worked for lead carbonate discovered by Col. J. S. Hutchison, who located both the Graphic and the Juanita claims early in 1866. The easily reduced lead carbonates were shortly after that date smelted in adobe furnaces (Mexican fashion) and the resulting pig lead was shipped over the old Santa Fe trail by ox teams to St. Louis, Mo. Some years later other pioneers conducted smelting operations in adobe furnaces, at a point close to Kelly, known as South camp, where also the first water-jacket furnace erected in the district was put in operation in 1880. As active developments were carried out large bodies of lead carbonate were discovered in the Kelly and in the Graphic claims in 1878-9, when it might be said the district took on its first boom.

The Rio Grande smelter at Socorro was built in 1881 by the late Gustave Billings who, having previously purchased the Kelly mine, was also largely instrumental in having the railway extended in order to facilitate shipping the Kelly ores to his furnaces. The Rio Grande smelter was successfully operated for several years, obtaining a supply of silicious ores from various mining camps tributary to the Santa Fe system. The plant, however, was not sufficiently well located either as regards ore supply, fuel, or fluxes to compete successfully with the large and well established plants in Pueblo and elsewhere, particularly when the local carbonate supplies began to fall off materially in their production and quality; hence, after the practical exhaustion of the lead carbonates of the Kelly mine, coincident with the depression of 1893, the Rio Grande smelter closed down and has not since been operated. A smelter of about 100 tons daily capacity was erected at the Graphic mine in 1896, but inasmuch as an ample supply of profitable silicious ore was not obtainable in the Magdalena districts, a smelter there would be compelled to obtain its profits from smelting lead-carbonate ores, or from the importation of silicious ores at heavy freight rates on a mountain road with an uphill pull on fuel and supplies. This plant was, as one would expect, short lived. The suspension of smelting operations at the Graphic plant may be said to mark the closing of the lead-carbonate period at Magdalena, and with the exhaustion of the large bodies of these ores, mining in the district came practically to a standstill. As usual, however, the mines were leased, so that the gleanings from the old stopes and workings might be harvested, and peradventure some new bodies discovered by the intelligent work of the leasers. The leasers here were destined, as in so many other cases, to bring the district in a short time from a state of suspended animation to one of vigorous activity.

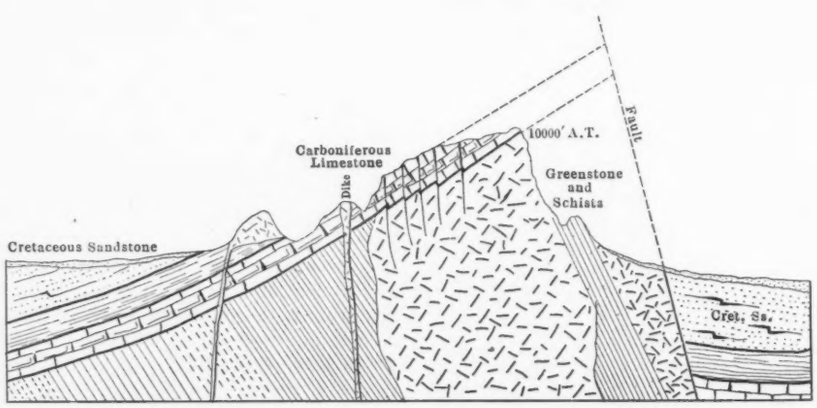

FIG. 2. GEOLOGICAL CROSS-SECTION OF THEMAGDALENA MOUNTAINS, NEW MEXICO

The Beginning of the Zinc Industry

In 1893 some leasers recognized the zinc carbonate ores so abundant in the zone of oxidation in close association with the lead-carbonate ores; they were equally fortunate in being able to secure a market for them in Wisconsin and in Missouri (Joplin) where smithsonite ores were for some time in high favor with the zinc-pigment manufacturers. Active prospecting opened up large bodies of zinc carbonate in both the Kelly and the Graphic mines, from which heavy shipments were made for several years. The smithsonite ores, however, gave place at a shallow depth to mixed oxide and sulphide of iron ore carrying zinc blende in varying quantities (a peculiar combination to be described later), and at moderate depth passed into solid sulphides in the Kelly

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mine, and doubtless will also do so in the Graphic when developed below the groundwater level.

This brings us to the last, or sulphide, period which was ushered in by the development, from 1904 to 1906, of large deposits of mixed iron oxide, zinc blende and pyrite, with some galena and chalcopyrite disseminated in small bunches throughout the deposit, in both the Graphic and the Kelly mines. The Kelly mine made quite heavy shipments during the latter year, while the Graphic company pushed development, to the extent, it is said, of developing about 100,000 tons of mixed oxide-sulphide ores, the zinc contents of which is not high enough to be valuable as a spelter ore; hence some method of eliminating the iron oxides and sulphides is necessary in order to raise the ore to the spelter tenor.

Geology

The Magdalena mountain range extends in a northerly direction from Kelly. The basal visible rock is an exceedingly compact schist, greenish in color and called by the miners "greenstone." This rock appears to form the principal mass of the mountain range and extends along its western flank, dipping about 30 deg. to the west and forms the floor of what we may call the ore measures. There is seldom any clean line of demarkation between the bottom bed of the crystalline limestone and the schists. They usually merge into each other, but in places in the Graphic mine a thin bed of quartzite occurs near the base of the crystalline limestone; in other places in both the Kelly and the Graphic mines a thin bed of pyritic material, carrying some copper, occurs adjacent to but above the quartzite. The copper oxides, on exposure, make a verdant coloration that excites the imagination of the miners, who invariably predict a rich copper deposit in depth, notwithstanding the fact that the ore deposits, confined to the limestones, are replacement deposits and that this particular cupreous pyrite bed is the lowest mineralization known in the ore measures. Some workings that have penetrated the underlying schists have, however, shown insignificant veinlets carrying chalcopyrite, but they lack continuity in both strike and dip and are simply gashes in the schist, which were probably filled from above.

The ore measures are well shown in Fig. 1, a section on natural scale through the Waldo tunnel of the Graphic mine. It will be noticed that the crystalline limestone is separated into an upper and lower series by a thin band called the "silver-pipe" limestone, a fine-grained, fossiliferous limestone about 6 ft. thick. This band is of such regularity and persistence throughout the district that it is invariably followed as a sort of indicator in the development of the mines, and because it has in places formed the plane of a bedded fault giving loose and better ground in which to drift.

The main ore deposits occur close to the silver-pipe stratum mostly in lower crystalline limestone in the Kelly mine, with the silver pipe forming the roof; and on both sides of the silver pipe in the Graphic; the formation is, however, mostly below it, but always in the crystalline limestone. This silver-pipe limestone has been but seldom attacked by the solutions that deposited the primary sulphides, yet strange to say, many acres of it have been replaced by the menstruum that circulated in the zone of oxidation; atom for atom, as it were, all structural details in this impure limestone are reproduced in the ore. Crinoid stems and shells of mollusks are found perfect in detail, but in zinc carbonate instead of the original lime carbonate. At the point where the Waldo tunnel intersects the silver pipe there is a well-pronounced bedded fault that can be traced almost to the end of the development north and south of the tunnel, a distance of 2000 ft. The throw, as I determined it at the dike which I fortunately located in a raise above the tunnel, is 40 ft. The ore measures on the line of this section, Fig. 1, are barren, while 800 ft. north on the strike of the silver pipe the upper and lower crystalline limestones have been almost entirely replaced by ore, while the silver pipe is either absent or included in the mineralization.

Overlying the upper crystalline limestone, Fig. 1, alternating beds of shale and quartzite occur, ending with a thin bed of limestone, mineralized in places (No. 4 winze). Next follows a thick bed of black carboniferous shale which brings us to what the miners call the "outer lime," an impure earthy limestone containing one, or perhaps two, horizons of mineralization which have been worked in several places in the oxidized zone. The ore is, however, of low grade and occurs in quite irregular deposits replacing the limestone metasomatically. This limestone is cut off on our line of section by the eruptive marked "rhyolite," a sort of granite porphyry called rhyolite in the field. Irregular deposits of blende and galena with pyrite occur in the shattered zone adjacent to this eruptive.

Positions of Ore Deposition

The positions of ore deposition in this formation which I have called the ore measures can now be summarized:

(1) The cupreous pyritic bed near the foot of the lower crystalline limestone; (2) the main and, so far, only important deposit, immediately above or below the silver-pipe stratum, sometimes on both sides of it; (3) the thin bed of crystalline limestone underlying the massive bed of carbonaceous shale; (4) the irregular deposits in the outer limestone. All four are metasomatic replacements of the limestone by the solutions that deposited the primary sulphides; (5) the vein-like deposit in the crushed and shattered zone between the outer limestone and the intrusive eruptive. It will be noticed that the Waldo tunnel penetrated this eruptive for about 400 ft. before reaching the shattered limestone zone; very little development has been conducted to open up the exposed ore at the contact, which consists of zinc blende, pyrite and galena, occurring in small lens-like deposits in soft porphyry and which forms a vein paralleling the outline of the eruptive. There are also some small and quite irregular replacement deposits in the shattered limestone. The eruptive porphyry is quite massive and in

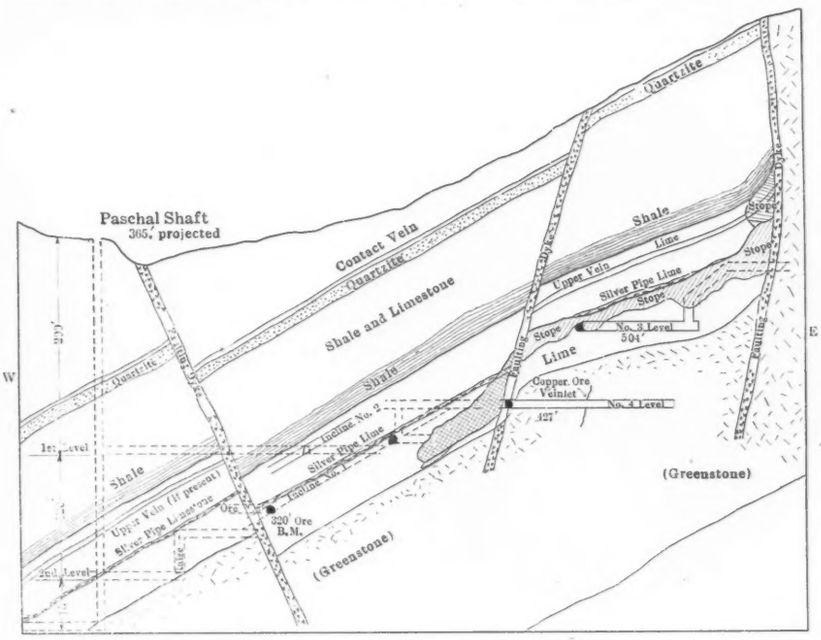


FIG. 3. SECTION SHOWING "SILVER PIPE" AND FAULTING DIKES

all probability extends across the valley and forms part of the western mountain mass. If so, it effectively cuts off the ore measures on their westerly dip.

Faulting at the Kelly Mine

Another section, Fig. 3, is taken through the most productive part of the Kelly mine. It shows three faults each filled with a dike. These I have called faulting dikes, the eastern one is a down-throw of something like 250 ft. The middle faulting dike results in a western down-throw of about 60 ft., while the western faulting dike is an up-throw of 25 ft. toward the west. The ore measures have been eroded east of the section, possibly to the top of the mountain, leaving the schists exposed. It will be noticed that almost the entire thickness of the upper and lower limestone has been stoped at the first faulting dike, while an upper vein has, in places, been indicated. Furthermore, the ore appears to have been continuous between the faulting dikes, and to

FIG. 4

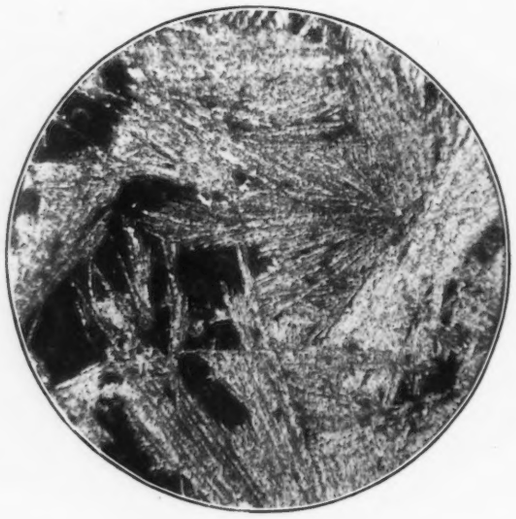


FIG. 5

BLENDE AND HEMATITE

have been mostly lead carbonate; the silver-pipe stratum was extensively mined for zinc carbonate. The workings varied from 8 to 20 ft. in hight, were in a dangerous condition at the time of my visit (1905), and collapsed shortly afterward. The silver-pipe stratum wherever visible showed replacement by zinc carbonate to more or less extent, and was in many places in a decidedly leached condition, having a honeycombed or loose, granular structure, usually quartzose. The "transition zone" may be said to begin at the bottom of the 60-ft. down-throw, but is, of course, irregular; some sulphides occur at the top of the down-throw and oxides are found 50 ft. below the bottom of it, notably in the chamber, indicated in hatched lines on the section, which was filled with impure smithsonite. Between the second and third faulting-dike, No. 1 incline follows the silver-pipe contact for 250 ft. through solid limestone without indication of mineral; but on nearing the up-throw faulting dike the rock became softened, stained with oxide and contained some ore at the dike, while north of the plane of section a large deposit of ore occurred. Another incline showed somewhat similar conditions, the most persistent ore near the dikes thinning out and disappearing in the intervening ground and indicating a close relation between the dikes and the ore deposits. These dikes in the Kelly faults corresponded to the main north and south faults that extend parallel with the main uplift of the mountain range and appear to me to antedate the ore deposits. There is another system of cross-faults, east and west, apparently of recent origin; in some cases they occurred possibly later than the main oxidation period, but mostly they were formed prior thereto. These, with the north-south faults, block out the ore measures in rough parallelograms. According to Charles R. Keyes,[1] the Magdalena range is one of the oldest in the basin region of New Mexico. It is, he says, a huge tilted block from which 5000 ft. of sedimentaries have been almost entirely removed, down to the Cambrian complex. Over the greater part of the range, the sedimentaries have been entirely eroded, leaving the schists to constitute the main mass of elevation while the ore deposits are situated on "one of the enormous plates of limestone that have been able to resist the attack of the elements." Fig. 2 shows "the general geotechnic features of the Magdalena range," with a main fault to the east of "not less than 5000 feet." Keyes considers the schists and granites to be Protezoic; the lower part of the limestone sequence, early Carboniferous; the upper limes late Carboniferous; while the north-south faults, in the mineralized area, are approximately parallel with the great fault, producing the mountain block, but of much later date. Be that as it may, I am inclined to the opinion that the faulting dikes are of the same period as the massive granite-porphyry eruptives that cut off the ore measures on their western dip (Fig. 1) and that the ore deposition is subsequent to both.

[1] *Mining Magazine*, Aug., 1905, p. 109.

Confining my observations to the Kelly mine, I noticed the faulting dikes were in places practically filled with vein quartz, blende and sulphide ore; that is to say, they had been in part changed by circulating waters from eruptive dikes to mineral veins by the removal of some of the rock constituents and the deposition of quartz, pyrites, etc., in their stead. This occurred, however, only in the region of the large ore deposits. At most places the dikes are straight granite-porphyry eruptives with no particular evidence of mineralization. They vary in thickness from a few inches up to 10 ft.

Irregularities of Ore Deposition

Owing to the extensive oxidation near the dikes I could not find any primary sulphides from which deduction might be drawn regarding the order of ore deposition or faulting. Briefly, however, my observations in the Kelly mine show:

(1) That the ore is found in larger quantities and of greater value adjacent to the north-south faulting dikes; (2) the crystalline limestone at the silver-pipe contact is not uniformly replaced by ore from one faulting dike to another, but the ore becomes thinner and more irregular as it is followed away from a given dike, finally ceasing at a moderate distance along the dip of the beds; (3) the primary sulphides, as seen in the deeper workings, point conclusively to metasomatic replacement of the lower crystalline limestone, immediately below the silver-pipe stratum, by iron, zinc and lead sulphides in lens-like deposits; (4) the oxidation has extended, in the deeper workings, from the faulting dikes, both up and down, along

the bedding plane of the limestone, showing that the faulting dikes are even now water channels or at least planes of permeability favoring the descent of meteoric waters.

For these reasons I am rather inclined to the theory that the ore deposits of the Kelly mine were formed by solutions which circulated in the north-south faulting-dike fissures.

The ore deposits in the Graphic mine appear closely related to dikes and faults, but as the workings are mostly in the oxidized zone and to a large extent abandoned, I could not obtain any data (May, 1907) on the exact relation of one to the other. The mine superintendent, however, informed me that he had not observed dikes to occur in the north-south faults in the Graphic mine. The large mass of mixed sulphides occurring on the eighth and ninth levels, north of the Waldo tunnel, show several small north-south faults, but no dikes that I could detect. Faulting along the plane of the silver-pipe

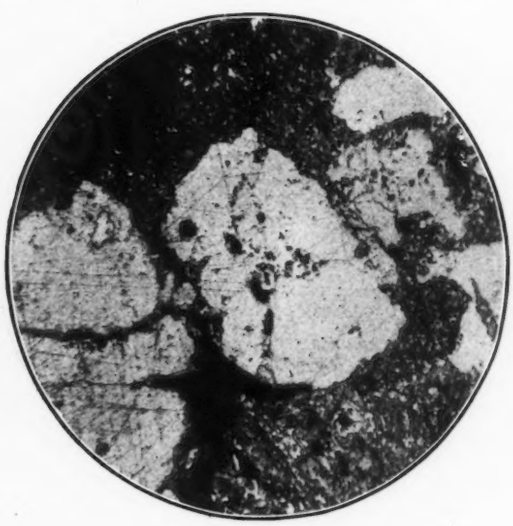


FIG. 6

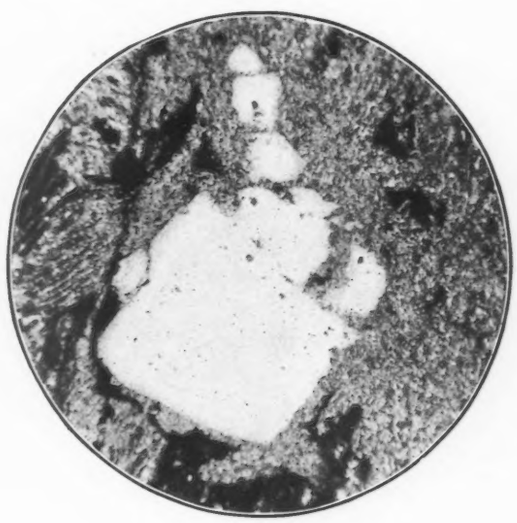


FIG. 7

PYRITE AND HEMATITE

is, in the Graphic mine, everywhere in evidence, and this bedded fault has carried oxidation to great depths.

Ores and Minerals

The commercial ores are cerrussite, smithsonite, zinc blende, galena and oxidized copper ore, together with some native copper. Owing to the great variety of minerals found in the oxidized zone, these mines have long been famous for their rare mineral specimens. Zinc occurs as smithsonite with its variations, hydrozincite and monheimite in various colors, green, brown, yellow, pearl and gray with several intermediate shades. A beautiful green variety much sought after for jewelry was analyzed by Prof. W. P. Headden, with results as follows: CO_2, 35.12 per cent.; ZnO, 60.97; CuO, 3.48; CdO, 0.16; CaO, 0.44; FeO, PbO, and MnO, traces. Aurichalcite, the basic carbonate of zinc and copper, and chalcophanite, the oxide of zinc and manganese, are both rare minerals, but are not uncommon at Kelly.

Copper occurs in the native state, sometimes in masses of several tons while as scales and veinlets, penetrating the smithsonite deposits, it is quite common. Cuprite and azurite occur in beautiful crystals lining cavities. Malachite and other oxidation products of copper are of common occurrence; in fact, I believe a close examination of the Magdalena ore deposits would disclose nearly all the oxidized zinc and copper ores known, while a close study of the zone of oxidation in which all these secondary minerals occur would throw a flood of light on a subject that has not received the attention its importance would appear to demand.

Primary, Secondary and Tertiary Ore Deposits

The primary ores are undoubtedly mixed sulphides; that is to say, iron pyrites, zinc blende and chalcopyrite occurring quantitatively in the order given. I have seen them only in two places in the Kelly mine, and possibly one place in the Graphic where a drift on the ninth level, passing out of the faulted zone, entered massive and solid sulphides inclosed in marbleized limestone.

Between the zone of complete oxidation and the sulphide zone, there occurs in the Kelly mine, and to a much greater extent in the Graphic mine, a zone of mixed oxides and sulphides in which the predominating mineral hematite—chiefly of the specular variety—is difficult to distinguish from zinc blende in the mines; the red streak, however, first called my attention to the combination while sampling the Kelly mine about two years ago.

I am indebted to Prof. William Campbell, of Columbia University, for an examination of this peculiar ore, and for the micrographs that accompany this paper. His description follows: "The principal mineral is hematite, which is shown as rosettes in Figs. 4 and 5; the black ground-mass is chiefly blende, and is, therefore, much later, I believe. Fig. 6 shows rounded and fractured grains of pyrite, seemingly eroded before the hematite came in. Fig. 7 is similar, but some chalcopyrite occurs around the pyrite, though the print does not show it. Fig. 8 shows more blende, which constitutes the black ground-mass. Fig. 9 shows fractured, dull grains of pyrite, a bright irregular mass of chalcopyrite opposite and to the left, and black blende. The rough matrix is hematite as before. The apparent order is pyrite, hematite, chalcopyrite and blende."

The order of deposition is somewhat peculiar, inasmuch as zinc blende, usually the first sulphide to pass into solution in the zone of oxidation, is the last to be reduced in the region of secondary sulphide deposition; but there is a possible explanation for this as I shall presently show.

The mixed oxi-sulphide ores described by Professor Campbell, occur practically at the ground-water level. The main oreshoot contains numerous small pipes of oxidized ore within its mass, while many of the larger joints and faults are also filled with iron ochre. In a word, it is a transition deposit lying between the principal zones of oxides and sulphides, merging on following upward, into the thoroughly oxidized deposits; no doubt it will pass into the zone of primary sulphides when followed to depth below the ground-water level; thus it belongs in part to both zones and for distinctness we will call it the "transition zone."

In the Kelly mine I have traced the ore deposit from the zones of oxidation, through that of transition into what is undoubtedly the zone of primary sulphides. Here galena appeared to favor the footwall portion of the deposit, pyrite being more plentiful near the walls or at

the beginning or termination of an oreshoot. Both the mixed sulphide ores and the crystalline limestone have been subject to extensive corrosion in this transition zone. In one place I noticed a white, amorphous, zinc carbonate (evidently a chemical precipitate) filling an irregularly corroded channel or water-course, in the mixed sulphides and hematite ores of this zone. This zinc carbonate assayed: Zinc, 41.20 per cent.; lime, 0.40; insoluble, 12.60; sulphur, 0.51. In other places similar, white carbonate marked the bedding plane in these ores, while channels or pipes of corrosion, partially filled with oxide of iron or entirely with an impure partially crystalline smithsonite, are of common occurrence. I examined one cavern in this crystalline limestone, in the Kelly mine, out of which was mined about 15,000 to 20,000 tons of semi-crystalline smithsonite averaging about 34 per cent. zinc. This ore crystallized in a pre-existing cavity. In fact all the crystalline smithsonite is "cave ore;" that is to say, it crystallized in open cavities, which usually occur in crystalline limestone.

In the Graphic mine, from which the specimens examined by Professor Campbell were obtained, the transition zone is much broken and contains many open joints resulting from a bedded fault and some small vertical faults. The great mass of the developed oreshoot, however, consists of a mixture of hematite, zinc blende, pyrite, etc., which is shown in the micrographs. Beyond the influence of the faults, where the ore occurs in solid, unaltered limestone as in the 9th level, northeast Waldo, the formation is mostly pyrite, with resin blende, second in order of abundance; these are followed by galena, which forms about 4 per cent. of the sulphides, and chalcopyrite constituting less than 2 per cent. These I believe are the primary ores, and they are largely pyritic and it is safe I believe, to assume that the present "transition zone" has been subjected to much corrosion from circulating solutions through which the finer blende particles have been removed with the more soluble sulphides, leaving spaces for the deposition of secondary minerals, with pyrite as one of the reducing agents.

The complex faulting with the shallow rock cover over the ore deposits presented ideal conditions for oxidation. The climate was arid in all probability, as at present, and the oxidizing menstruum was very limited, resulting in strong solutions and intense corrosion. The metals probably did not travel far, zinc sulphate becoming fixed as carbonate replacing the lime in the silver-pipe stratum and, in part, the crystalline limestone. Copper salts were reduced to the higher oxides or to metallic copper close to the point of oxidation, while galena, the last sulphide to oxidize, is found as carbonate in cave-like deposits near the point of oxidation, not unlike the Leadville lead-carbonate deposits. Thus it would appear that iron salts alone moved downward in relative abundance toward the ground-water level and became deposited in the corroded veins as hematite, to be later augmented by chalcopyrite and zinc, the base iron forming the greater mass of the secondary deposit. The usual zone of enrichment in mineral veins becomes here a *zone of impoverishment* so far as the pay ores, zinc and lead, are concerned. The Leadville and the Magdalena deposits are both in the Carboniferous limes and are mineral-bearing at Red Cliff, Aspen, Leadville and elsewhere. The Leadville deposits were doubtless oxidized in the presence of an abundance of water which washed out nearly all of the zinc, and much of the iron. Whereas, the Kelly deposits are, I presume, typical of arid-climate oxidation with the zinc and copper fixed close to the point of oxidation, but in another form. The possible deposition (I can see no other way to account for it) of the hematite in such abundance at the ground-water level, reversing the usual order of things and creating a zone of impoverishment where there is usually one of enrichment, is something novel.

Conclusions

On the foregoing tentative assumption the oxidation might be considered to progress somewhat as follows: (1) Oxidation of zinc sulphide, the resulting sulphate replacing certain limestones as zinc carbonate (secondary ore), the lime passing into solution. (2) In part contemporaneous with the first; pyrite oxidizing; descent of corrosive solutions and iron salts; formation of caverns, water courses, etc.; and deposition of hematite in the vein near the ground-water level. (3) Leaching of the secondary zinc carbonate ores (bedded deposits) formed, during the first oxidation period, possibly by carbonated waters and the crystallization of the soluble zinc carbonate in the previously eroded caves, water courses, etc., adjacent to the ground-water level; these formed the so-called "tertiary ores." Part of the zinc carbonate was doubtless deposited as sulphide (zinc blende) in the vein matrix during this period. (4) Moisture permeating these tertiary smithsonites emerges in places as highly concentrated solutions of zinc carbonate and these deposit in cavities, or as linings of geodes, crystalline smithsonite of great purity, but strained with copper and other metals. The semi-precious smithsonite might perhaps be called a Quarternary ore.

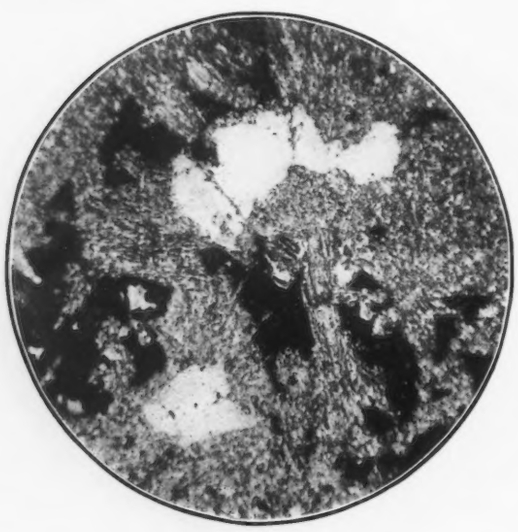


FIG. 8

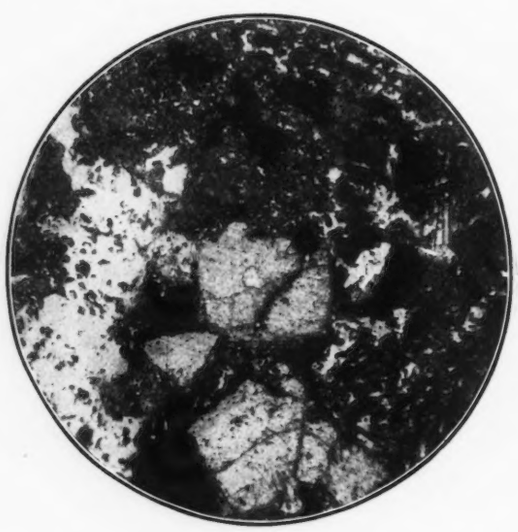


FIG. 9

PYRITE, BLENDE AND HEMATITE

Owing to shortage of labor some of the gold mining companies of Brazil, according to the *Brazilian Engineering and Mining Review*, are negotiating with the Japanese minister to Brazil for the importation of Japanese to supply the shortage.

Mining Lode Tin in Malaya

SPECIAL CORRESPONDENCE

In a recently issued report, J. B. Scrivenor, geologist of the Federated Malay States, describes the tin-mining industry of the Malay peninsula, giving particular attention, however, to those localities in which tin ore is being recovered from its native rock, and having but little to say about the better known alluvial deposits. The importance of the lode deposits is becoming more and more pressing as the end of the rich alluvial workings gets nearer, and it is not unlikely that the lode deposits will soon have to provide an important part of the output from the Malay peninsula.

EAST COAST

Tin mining in Pahang is handicapped by difficulty of access, but there are many reasons to suppose that important alluvial deposits, though perhaps not equal in size to those on the west coast, exist here, waiting only for conditions more favorable to their discovery. The former idea that the granite axis of the peninsula is the seat of the tin ore and that the greater magnitude of the alluvial deposits on the west coast is due to the preponderance of the drainage in that direction, is now being abandoned. Tin ore has lately been found in granites, schists and limestones at a distance from the axis of the peninsula, and it is not necessary to look to the central granite mass for the origin of all alluvial deposits in the country. Some of them have doubtless been formed by decomposition of tin-bearing rocks close to the present position of the alluvial workings.

The best known mines on the east coast are those of the Pehang Consolidated Company, at Sungei Lembing, in Kuantan. The deposits here bear a striking resemblance to the veins of Cornwall. The country is a hard, dark slate with some andalusite and tourmaline schist; the tin ore occurs chiefly as an impregnation in the walls of fissures. The workings will soon pass into granite, into which it is expected that the veins will enter with undiminished richness.

The Bundi Tin Mining Syndicate's mine at Bundi, Kemaman, is second in importance. The deposit is a mass of clay, sand, quartz, soft sulphides and hard iron oxides, resting in a trough in granite. The trough is 1500 ft. long, has a maximum width of 120 ft., and a depth ranging from 80 to more than 150 ft. Tin ore occurs in workable amounts in the soft clay and in the iron-stone. It is peculiar in structure, being found almost always in the form of small, slender, sharply defined, pale yellow needles, which are occasionally grouped into a spongy mass. Tin ore is also found in the fresh granite, but not in workable quantities.

At the Machi tinfield, which lies to the south of Bentong and not far from the Negri Sembilan border, the principal operations are in shallow alluvial soil, and are conducted in a wasteful manner by Chinamen. A tin-bearing lode also has been found and slightly developed. It is 8 ft. wide and is contained in a hard, silicified shale. The vein filling is mainly quartz, carrying a large proportion of a pale yellow, opaque garnet, together with cassiterite, blende and arsenopyrite. An average sample gave 6.20 per cent. tin oxide.

MAIN RANGE

Nearly all the tin ore recovered on the main range of the peninsula is obtained by native tributers working on a small scale by washing and picking in the beds of rivers. Such operations in the Chinchong river, in the hills back of Bentong, have uncovered great numbers of boulders of a remarkable rock which is quite likely the original source of the alluvial tin. The rock is composed of quartz, topaz and cassiterite, all about of the same grain. The cassiterite, constituting about 7 per cent. of the rock, occurs in easily discernible, brilliant little crystals. The topaz also constitutes about 7 per cent. of the rock, but is not easily distinguished from the quartz except by a microscope. These boulders are thought to be in sufficient quantities to warrant investigation into a method of working them for their contained tin.

On the top of Gunong Gapis, at an elevation of 2400 ft., is a mass of soft pegmatite carrying disseminated tin, which is also found in stringers and pockets with tourmaline and quartz. The deposit is being worked by the Sempam and Gapis Mining Syndicate. Near Bukit Fraser, at an elevation of 4000 ft., the Sempam Tin Mining Company owns a large area of land which it is working through tributers. At one spot is a mass of ore in granite consisting of quartz, tourmaline and cassiterite. Tin-bearing pegmatite also occurs in the neighborhood.

WEST SIDE

On the west side of the main range, increased attention is being paid to lode and other deposits in which the tin ore is contained as an original constituent. At Chin-Chin, Malacca, a surface deposit of laterite containing tin is being worked by quarry methods, owing to its being cemented with iron oxide. The tin ore occurs in sharply angular lumps varying in size from grains to pieces weighing several pounds. Near Tanjong Serai, Malacca, a suction dredge is extracting tin ore from below low-tide mark. The original rock in this locality is a schist which has been decomposed into laterite. The bulk of the ore, which is very rich, was taken from a thin layer of black mud on the sea bottom, which represents the concentration of cassiterite by wave or other action.

The Bruseh Hydraulic Tin-Mining Company has finally abandoned its hydraulicking operations on surface soil and alluvial ground and has turned its attention to a multitude of thin tin-bearing veins in schist. The company is now confining its work to the hill between the Pinang and Durian rivers. On the Durian river side a huge pit has been dug with an outlet to the valley and a face 230 ft. high. The schists were originally of the garnet-pyroxene variety, but have decomposed into sandy and clayey masses. The veins are numerous and generally rich in tourmaline, which extends for some inches from the fissure, the latter being filled nearly solid with cassiterite. The average thickness of the veins is 1 in.; they are generally parallel to each other, and seem to favor the sandy portions of the decomposed schist. The schists are sufficiently decomposed to permit working by hydraulic methods, with giants, although occasionally a face has to be left for a month or more to weather, before the giants can make an impression on it. The average yield of ground in which the veins are inclosed is 0.66 lb. per cubic yard.

The operations of the Jeher Hydraulic Tin-Mining Company, near Tanjong Malim, resemble somewhat those of the Bruseh company, just described. The country is sandstone and shale, in which are quartz veins carrying cassiterite. The veins have clean-cut walls, and tourmaline is nearly absent.

The Serendah Hydraulic Tin-Mining Company is working with giants on old alluvial workings, but has also uncovered a large area of soft granitic rock which contains tin-bearing quartz veins and also greisen zones carrying tin. One such zone stands up like a dike above the soft granite; it is 20 to 30 ft. wide and 150 ft. long. Its constituents are quartz, muscovite, tourmaline, kaolin and cassiterite, the latter seeming to be an original component of the rock.

TIN ORE IN LIMESTONE

Payable deposits of tin ore have been discovered in limestone at a number of localities in Perak. At the Changkat Pari mine, near Ipoh, a large shaft has been sunk 100 ft. The deposit has an elliptical outline, but without distinct walls; a division can be seen, however, between the calcite associated with the cassiterite and the crystalline limestone country. A yield of 5 per cent. tin oxide from the bottom of the workings is considered low. A typical specimen of the ore shows a mass of calcite crystals inclosing short prisms of dark brown cassiterite, pyrite, arsenopyrite, chalcopyrite and bornite; tourmaline, fluorite and quartz are absent. The ore is stamped, roasted and then washed in a riffle box.

The Ayer Dangsang deposit, near Lahat, worked by the Société des Etains de Kinta, strongly resembles the one just described. A big shaft has been sunk 88 ft. The mineral associations are the same as in the Changkat Pari, with the addition of a little quartz, fluorspar and tourmaline. The same French company is operating a deposit at Siak, near Siputeh, which consists of limestone fissured and impregnated in small zones with cassiterite, fluorite, arsenopyrite, quartz and calcite, all in well shaped crystals. The company prospected with a diamond drill and decided that underground work would not pay.

In Jesophat's valley, Singei Siput, Kuala Dipang, is a peculiar deposit in limestone. There is a deep fissure from which a soft, muddy ore was taken for some time, but as the work got deeper the ore became harder and had to be stamped. The ore is hoisted out of the fissure on an inclined tram and then lowered down the side of the hill to a small stamp mill with a Wilfley table. The ore consists of a matrix of iron-stained calcite inclosing rounded grains of quartz, ilmenite and cassiterite. The yield of the mine for a year averaged more than 4 per cent. tin oxide. The junction between the ore and the limestone wall is sharp, and there is no sign of impregnation. The deposit seems to have been a "swallow hole," into which tin and other heavy minerals have been concentrated by stream action, and have finally been cemented together with calcite derived from the surrounding limestone. The presence of neighboring granites and tourmaline-bearing sedimentaries, as well as original cassiterite in surrounding limestones, would account for the source of the ore minerals.

The Lahat "pipe" is a remarkable occurrence of tin ore. It is near the village of Lahat, and is worked by the Société des Etains de Kinta. The pipe has been worked to a depth of 150 ft., is almost cylindrical, and has a diameter of 25 ft. It descends into the limestone at an angle of about 5 deg. from the vertical. It was filled with a hard, red mixture consisting of limonite, calcite and cassiterite, the latter being in sharp, angular fragments. Tourmaline is absent, and rounded grains of quartz are rare. It is difficult to state with decision the origin of this remarkable deposit, but the weight of evidence seems to favor an origin like that of Jesophat's valley, which is evidently a detrital deposit.

The characteristic features of all these limestone deposits are the abundance of sulphides, especially arsenopyrite, and the absence of tourmaline. Quartz, likewise, is found only sparingly at the Ayer Dangsang mine, and not at all at the Changkat Pari.

Maximum profit per ton, not minimum cost per ton, should be the aim in mining and in metallurgy.

Electrolytic Determination of Zinc

F. C. Frary (*Journ.* Am. Chem. Soc., XXIX, pp. 1596-1603) describes a series of experiments in rapid determination of zinc by electrolysis. The apparatus used was that devised by the author, in which the electrolyte is electromagnetically rotated. A few preliminary experiments with an acetate solution gave coarse crystalline deposits of the metal which were adherent enough to a dish to allow of washing, but which were easily brushed off from a gauze cathode, while an alkaline electrolyte gave good results. In the experiments when the electrolyte was rotated a cylindrical gauze cathode was used, but in most of the other cases a nickel disk was employed. The zinc was dissolved from the nickel cathode, after weighing, by a sulphuric-acid treatment. The amount of nickel dissolved by this treatment varied from none to 10.4 mg., the average being about 1 mg. per determination.

The cathode was 5 cm. high and fitted the beaker closely. The anode was a spiral of 1-mm. platinum wire which slowly became brown by use. Various acid treatments did not remove the color, but ignition at a comparatively low temperature restored the platinum color. The loss in weight of the anode was negligible for ordinary work.

In the experiments carried out by the author the volume of the electrolyte was from 100 to 125 c.c. In some of the experiments in which the electrolyte was magnetically rotated, the electrolyte was cooled by surrounding the beaker with a coil of lead pipe through which flowed a current of water. The cover glasses and sides of the beaker were washed down with water 5 min. before the end of the electrolysis, or, in cases in which the current was reduced for the second part of the analysis, the washing immediately followed the current reduction.

At the end of the electrolysis the current was reduced to one ampere and the alkaline solution drawn off and replaced with distilled water, without interrupting the current, at the same time being careful not to expose the zinc deposit to the air until the replacement was practically complete. The first 200 c.c. of the alkaline liquid was reserved for testing. The cathode was rinsed with alcohol, dried at 100 to 120 deg. C., cooled in a dessicator and weighed. The electrolyte used contained about 8 grams sodium hydroxide per 100 c.c. of electrolyte.

The test used for zinc in the spent electrolyte was to acidify the first 200 c.c. with sulphuric acid and then to add 3 to 4 c.c. of a 10-per cent. solution of potassium ferrocyanide. The test was allowed to stand 10 min. if no precipitate showed at first, because with small amounts of zinc precipitation takes place slowly.

The points particularly investigated were the time necessary for complete deposition, and the effect of temperature. The results are best shown in the author's summary as follows:

(1) With electromagnetic rotation of the electrolyte 0.1 gram zinc can be completely precipitated by 4.5 amp. in 30 min. on a nickel gauze cathode. About 8 grams of sodium hydroxide should be used and the electrolysis should be conducted at as low a temperature as possible.

(2) For quantities of zinc up to 0.2 gram, the current strength should be 4 to 5 amp. for 15 min. and then about 1.5 amp. for 20 min., the other conditions as in (1).

(3) The testing of the liquid after electrolysis is essential.

(4) It is highly improbable that complete precipitation of 0.2 gram zinc can be obtained with 5 amp. in 15 to 20 min. as stated by Exner and Ingham.[1] From the results obtained it would also seem improbable that the concordant results obtained by Miss Languess[2] with 10 to 13 amp. in 3 min. represent complete precipitation.

[1] *Journ.* Am. Chem. Soc., XXV, 896. Ibid 26, 1269.

[2] Ibid 29, 459.

Mount Lyell Mining and Railway Company

The report of the Mount Lyell Mining and Railway Company is for the half-year ended March 31, 1908. The ore treated was as follows: From Mount Lyell mine, 139,691 tons; from North Mount Lyell, 63,250 tons; total, 202,941 tons, averaging 2.45 per cent. copper, 1.77 oz. silver, and 0.049 oz. gold per ton; also 7525 tons of metal-bearing fluxes and 204 tons of purchased ore. The total production was 4301 tons of blister copper containing 4247 tons of fine copper, 344,608 oz. silver and 10,489 oz. gold.

A net profit of £128,981 was made for the half-year, after providing £17,631 for prospecting and development not charged to the mine preparatory works account, and £9723 for depreciation of plant and buildings. The cost of producing blister copper was $3.6878 per ton of ore against $3.704 in the previous half-year.

The ore reserves in the Mount Lyell mine are estimated to be 3,523,000 tons, averaging about 0.54 per cent. copper, 1.96 oz. silver, and 0.03 oz. gold; in the North Mount Lyell mine, including Lyell Tharsis, the reserves are estimated to be 606,600 tons averaging 5.75 per cent. copper, 1.33 oz. silver and 0.005 oz. gold.

The development of the mines at depth is encouraging. At the 1000-ft. level the orebody continues as large as at the 850-ft. level, and at the latter point and upper levels the orebodies have been proved to cover a larger area than was supposed.

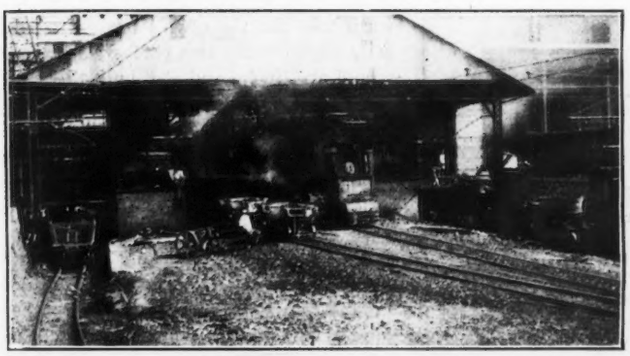
Drill steel should be bought in lengths suitable for cutting up without waste.

Smelter of Penoles Company, Mapimi, Mex.—II

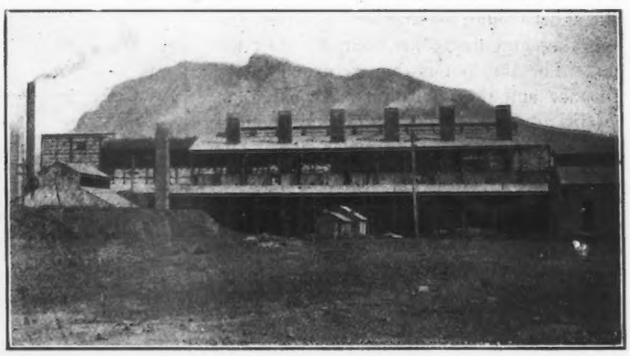
Several Innovations Have Been Introduced; When Work of Centralization Is Completed the Plant Will Be One of the Most Modern in Mexico

BY CLAUDE T. RICE

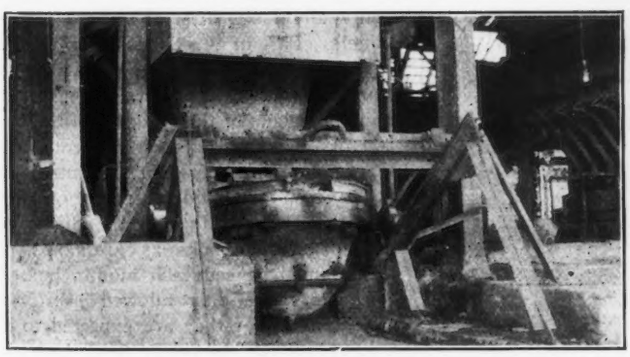
Formerly the Peñoles company operated three smelters at Mapimí, but gradually during the last few years the smelters and the power plant have been undergoing a process of centralization. As yet this centralizing and modernizing of the smelter has not been completed and much construction work is still going on, but when the work is completed, this smelter will be one of the most modern in Mexico, and several innovations in smelting will be tried out.



SLAG SETTLERS, AND SLAG TRAINS LOADING, MAPIMI SMELTERY



BLAST FURNACES, MAPIMI SMELTERY



MOVABLE SLAG RECEIVER, USED INSTEAD OF FOREHEARTH, MAPIMI SMELTERY

FRONT OF BLAST FURNACES SHOWING TRAVELING CRANE AND SLAG-RECEIVING POTS

Formerly the plant was equipped with several reverberatory roasters in which the ore was roasted down to about 11 per cent. sulphur and then charged into the Huntington-Heberlein pots, the plant being equipped with 12 of these; but these reverberatories have been converted into furnaces for recovering arsenic from the flue dust. Consequently, as only a small amount of sulphide ore is being smelted, this ore as it accumulates is roasted in a small circular-hearth furnace and in the Heberlein pots. The oxidized ore and the roasted ore are then mixed with sufficient silicious ore and concentrates from Pachuca, Zacatecas and other silicious camps to flux the Ojuela ore which, as has been said, has an irony, calcareous gangue.

At the blast furnaces the old hand-feeding methods are being replaced by a system of mechanical charging, and new stock bins and tracks, on which to take the ore directly to the charging hoppers over the furnaces, have also been installed. These bins, which have a capacity of 10,000 tons, are arranged in a double series, divided into compartments, the gates of which face each other and between which the tracks for the charge cars extend. In front of each pair of doors Anaconda track-scales are installed to permit quick weighing of the charge, and the compartments are equipped with a new type of hydraulically operated gate door, operated by a hand lever placed near the scales. In the different compartments flux, ore and coke will be kept; trains of charge cars will be run under the chutes and quickly loaded with the right proportion of ore, flux and coke.

The charge cars are then run in trains, up an incline track, over the battery of furnaces, and there dumped into double-feed hoppers, two different types of which are being tried. One type has no bottom gates in it, the ore feeding down into the furnace as the charge melts; in the other type the hoppers are equipped with four bottom gates, operated by levers so that in this type of feed hopper the distribution of the charge in the furnace can be regulated.

The smelter is equipped with six 162x46-in. furnaces having Robinson air-tight tuyeres. These seem to work admirably for there is a remarkable absence of leakage about the tuyeres, and it is stated that, compared with the amount of air necessary when other types of tuyeres were used, a 20-per cent. saving in the amount of air used per ton of charge has been effected by the use of the Robinson tuyere.

A Movable Slag Pot Instead of Forehearth

Another feature of these furnaces is that they have no forehearths, but instead, the slag and matte is drawn into large movable slag pots which, when full, are taken by a traveling electric crane to

the slag settler resembling a small reverberatory furnace. The bullion is drawn off in the usual way.

The large slag pot, which receives the slag and matte, consists of a pot proper having a capacity of five tons, to which a long bail is fastened by means of trunnions which, extending beyond the bail, serve as wheels when the pot is sliding down the inclined track into position under the slag spout. This inclined track is made long enough to extend beyond the overhang of the furnace so that the crane can lower the pot upon the track; the bail of the pot is also made long, permitting the operator to hook the tackle of the crane directly into the ring of the bail.

The pot, when full, is taken by the traveling crane to the settler, which has a capacity of 80 tons. Here another hook is lowered from the crane and hooked into a ring near the bottom of the pot. The crane car is then run out over the short trough leading to the settler, and the slag and matte are poured out of the pot. The slag pot is then returned to the furnace and the operation is repeated.

The advantages of this method of movable receiving pot and settler are: The furnace is always accessible and not encumbered with a lot of tracks and slag cars; the slag can be allowed to remain quiet long enough to assure a complete separation of any matte or metal entrained in the slag; the amount of fumes about the furnace is decreased; and finally the slag trains are made up without disturbing the work by switching in and out at the different furnaces.

The furnaces are being equipped with balloon dust-settlers, which will greatly improve conditions about the furnaces. The dust from the dust-settlers, composed mainly of arsenical oxides (the Ojuela ore carries about 9 per cent. arsenic) is being treated in a reverberatory furnace, equipped with numerous baffles, where it is refined for the market. None of the bullion is refined at this smelter, but is shipped in bars either to Antwerp, Belgium or to the United States to be refined.

The smelter is equipped with two Connersville blowers, having a capacity of 35,000 cu.ft. per minute, driven by Nordberg engines. One of these blowers is held in reserve, and there is also a small blower driven by an electric motor, which is cut-in automatically by means of a manometer which makes an electric contact whenever the pressure of the blast drops below 20 oz. per sq.in. This prevents any accident which might result from the sudden stoppage of the blast to the tuyeres due to a sudden break-down of the main blower.

The power plant is now completely centralized and is well equipped with Heine boilers, Corliss engines, alternating-current generators for supplying power to the mines, and direct-current generators for the smelter circuit. A storage battery, large enough to run the auxiliary machinery at the smelter for four hours in case of a break-down, is also added to the direct-current circuit so as to equalize the load on the generator.

The smelter is being equipped with self-supporting steel chimneys, 300 ft. high, and one of these is already in use, but at present one of the wooden stacks, 340 ft. high, is still in operation. These wooden stacks are supported by timber framing, as shown by an accompanying illustration. They are cheaply and quickly built and work well, except that they are somewhat liable to catch fire. The capacity of the smelter is 1000 tons, but at present only about 700 tons are being smelted, most of this being oxidized ore.

Treatment of Employees

The Compañia Minera de Peñoles has always been noted for the good treatment

WOODEN STACK, MAPIMI SMELTERY

of its employees and it is encouraging to learn that all connected with the company seem to think that this policy has paid. The Mexicans working at the mines are better paid than elsewhere in eastern Mexico, and many provisions have been made for their comfort. Consequently during the recent active times, when other companies were short of miners, the Peñoles company had no trouble in getting all the miners that it desired. Although the town of Ojuela, owing to the nature of its *peon* inhabitants, is far from being above improvement, it would be well for some other companies in Mexico to follow the public-spirited way in which the Peñoles company deals with its employees at the mine.

In the first place, the Compañia Minera de Peñoles depends upon its mines and smelter for its profit. It runs no stores and rents no houses to its employees, but instead it furnishes houses free to the employees at the mine. It also provides free baths with hot and cold water for its single employees at the mine, and for the families of the miners free baths are furnished at the town. The stores, billiard halls, etc., at Ojuela are rented to individuals at a nominal price, and the company has built a modern, electric-lighted theater, where the employees can have entertainments, or which traveling theatrical companies can rent at a price merely sufficient to pay the cost of lighting and cleaning. In short, the company does every reasonable thing that can be done to improve the condition and comfort of its employees; for instance, as the miners' wives found it hard to wash owing to the scarcity of water on the mountain, the company erected a number of stationary wash tubs for the town's use. The company pays for the two teachers who teach school at Ojuela, and also built the school house. In order that the employees shall have pure drinking water, the water for cooking and drinking is pumped from the spring at Mapimí. But water for the boilers, for washing, and for other purposes is pumped out of the mine.

At Mapimí the company has a nice modern hospital, in charge of a head doctor and two foreign trained nurses, where there is an excellent operating room and full equipment for all necessary surgical work. The assistant doctor lives at Ojuela, where he keeps a full line of drugs and looks after the health of the miners. Part of the expense for medical care is borne by the men and part by the company, the day's-pay men paying a certain percentage of their wage and the contractors paying a certain percentage of the amount that they earn on contract.

The men are paid as much of their wage each day as they desire, this being carried on the books as *prestamos,* or loans, and balanced each month, but the contractors are only allowed *prestamos* once a week, for they are expected to be somewhat more provident than the ordinary miner.

Conclusion

As the reader will notice, there is novelty at the mine and at the smelter, and especially in the treatment accorded the miners. In my mind this latter feature is most worthy of admiration, for while, obviously, the miners profit greatly through such treatment, it is gratifying to see that the company is sure that it profits equally.

In conclusion I wish to thank Dr. Kuno B. Heberlein, the general manager of the company, O. R. Whittaker, the superintendent of the mine, H. S. Mulliken, superintendent of the smelter, and C. Q. Schlerett, the engineer at the mine, for the many kindnesses shown me while I was at Mapimí.

Cottrell Process for Condensing Smelter Fumes

This Electrostatic System Is in Successful Operation at the Selby Smelter; Description of Apparatus Employed and Principles Involved

SPECIAL CORRESPONDENCE

The Cottrell process for the separation of suspended particles from gaseous bodies, details of which have not been obtainable up to the present time, has awakened, among those engaged in the smelting industries, much interest and speculation as regards the principle on which the process is based and the method employed in its operation. The successful application of the process by the Selby Smelting and Lead Company, of San Francisco, for arresting the ojectionable elements in the fumes escaping from its smeltery at the entrance of Carquinez straits, as mentioned in the JOURNAL of August 1, 1908, suggests a possible solution of the problem which has always been a source of annoyance, and often great expense, to many smelteries in this and other countries.

Foreign patents covering the process are well under way. Application was filed for the United States on July 9, 1907, but for some reason issue of the patent (No. 895,729) was with-held until August 11, 1908. The application names Fred'k. G. Cottrell, assignor to International Precipitation Company, of San Francisco, as the inventor.

PRINCIPLES OF THE PROCESS

Mr. Cottrell sets forth in the specifications of the patent that the invention relates to the art of separating finely divided particles of solids or liquids, originally held in suspension in bodies of gas or vapor, by the application of electric charges.

It has long been known that when gases containing suspended particles, such as smoke, fog, dust, mists, etc., are brought into the neighborhood of a body charged to a high electric potential with respect to its surroundings, that is, into an electric field, the suspended matter tends to be deposited. This is especially noticeable in the case of charged points, the particles being repelled from these. It has repeatedly been proposed to employ such agencies in technical operations; but, difficulties in their application and control have, up to the present, greatly limited their general introduction on a practical scale.

The improvements described are the logical outcome of an analysis of the underlying principles, with due regard to the structural and instrumental difficulties to be met with in their application. The result of such analysis leads to the following as conditions favorable for successful operation:

(1) The use of essentially direct currents, that is, constancy of direction of the force in the electric field.

(2) The charging of suspended particles by the action of an electrode presenting a considerable extent of surface over which a fairly uniform and moderately intense discharge of the brush or glow type, is maintained into the surrounding gas.

(3) The attraction and collection of the particles thus charged, by electrode surfaces of opposite polarity, upon which brush or glow discharge is reduced to a minimum.

(4) The passage of the particle-laden gases through the electric field produced by these electrodes, in such wise as to secure the most thorough and uniform treatment of the whole.

(5) Aside from the current carried by the gas and moving particles, the maintenance of as perfect insulation as possible between the two electrodes, more especially guarding against short-circuits and leaks through the material deposited out of the gases themselves during the operation.

The process has been designed to fulfil all the above conditions, and consists of the four essential elements and their combination, as follows:

(1) The maintaining at suitable relative electrical potentials of two types of electrode surface; (2) the charging of suspended particles by brush or glow discharge from the one type of electrode surface; (3) the attraction of the thus charged particles to the other type of electrode surface; (4) the prevention of the deposition of the suspended particles upon the surface of the solid insulating supports between the two types of electrodes.

DESCRIPTION OF THE APPARATUS AND THE METHOD OF OPERATION

The following description, in which it is indicated how each of the chief requirements may actually be met in practice, is a rather full abstract from the specifications:

"Fig. 1 is a general view of an apparatus by means of which my improvements may be carried out. Fig. 2 is a view showing a modification of the electrodes. Fig. 3 is a view showing another modified arrangement of the electrodes. Fig 4 is a view showing a modification of the synchronous contact device.

"Referring to Fig. 1, the gases or vapors containing the suspended particles enter the precipitation chamber *A* through the pipe *B*, and come into the proximity of the active electrode *C*, the body of which may be made of any suitable material. In the apparatus shown, the second "active electrode" (the two oppositely charged conductors or systems of conductors, between which the precipitation actually takes place, will hereafter be referred to as the "active electrodes" whatever their structure or other relations may be) consists of the walls of the precipitation chamber itself; but, the apparatus is not necessarily limited to this form of construction. For instance, in dispelling fog, the ground or water might be made one electrode and the other suspended freely above it. If the surface of both electrodes is as smooth as possible, the efficiency of the apparatus becomes relatively small, but, if the surface of one of the electrodes is supplied with sharp points and the potential difference is high enough, a rapid repulsion of the particles from these may be observed, together with a corresponding collection of deposited material on the other electrode. Modern theories explain this action on the ground that the gas in the neighborhood of the points becomes ionized, chiefly by brush or glow discharge, and the ions combine with or condense upon the suspended particles, dragging these with them toward bodies of opposite polarity. If, in each considerable region of the gas, wholly or partially bounded by the electrodes of opposite polarity, there are points on but one of the active electrodes, the ionization of the gas, produced in this region, will be practically of but one sign, and the particles will all move toward the other electrode, provided the polarity of the electrodes remains the same. If, on the other hand, both electrodes bounding this region are provided with points, or their polarity is being rapidly reversed, ions of both signs will be produced in the gas space and attach themselves to particles. Some of these will reach each electrode, but others will mutually neutralize each other in the gas space, possibly giving rise to larger aggregates in so doing, but, on the whole, the efficiency of precipitation is reduced. This is particularly true when the electrodes are excited from a source of alternating current, as in this case the same particle is drawn first one way and then the other, if the duration of alternation is small compared with the time of travel of the particle from the point where it receives its charge to the point of deposit.

"Just as many electro-chemical processes using unattackable electrodes in liquid solutions depend upon the character of the electrode surfaces, so in the present improvements, the character of the electrode

surfaces is of the utmost importance. Bare metallic electrodes of various forms and structure, including rods or wire with sharp points, wire gauze, fairly fine wire bristles, thin sheets, disks, etc., have all been tried and found impractical for treating large masses of gas; the chief objection to them lying in the intensity of electric field required and the great tendency for the discharge to become sharply localized. These difficulties are all avoided and the efficiency and ease of adjustment of the apparatus greatly increased, if the electrodes are simply covered, in whole or in part, with some soft, fibrous material, such as cotton or asbestos presenting a pubescent surface. These, although relatively poor conductors, amply suffice under the usual conditions and, if necessary, the material may be so treated as to increase its conductivity. Such an electrode shows in a dark room a uniform development of luminous discharge all over its surface, even when at a comparatively great distance from the other electrode. This permits a much lower potential difference, and the employment of a greater and less uniform distance between the electrodes.

The form of active electrode *C*, in Fig. 1, has been found very satisfactory. It consists of a cage of wire supported by a conducting rod *D*. Upon the surface of the cage, including the bottom, is wound or stretched some asbestos, very conveniently in the form of a small cord or thread *c*. The gas, issuing from the inlet *B*, receives the discharge from the filaments *c* of asbestos on the bottom of the cage, and many of the particles are driven back and precipitated in the lower part of the chamber. Those that escape and pass between the asbestos and wire meshes into the interior of the cage, are found to follow, approximately, the direction of the arrows, emerging from the sides of the cage, apparently because of a draft or current of gas maintained by the electric discharge from the electrode *C* to the walls of the vessel *A*, and the consequent rush of particles and gas in the same direction. In so doing, the current of gas is, of course, subjected to a second purification from suspended matter. The purified gases finally pass out by the exit *F*.

"Owing to the relatively high difference of potential between the two electrodes, they must be kept well insulated from one another. If this is effected merely by the use of solid insulators, at ordinary temperatures, there is great danger, in many cases, of the insulation being broken down by the deposit of some of the suspended matter upon the surface of the insulation, and consequent formation of a conducting film. This danger can be reduced somewhat by bringing the connection to and support for the inner electrode through the outer wall of the precipitation chamber in a part where the gas has its maximum purity from suspended matter. To further guard against any contamination from suspended matter that may have escaped precipitation by the electrodes before reaching this part of the chamber, an arrangement is shown in Fig. 1 for passing in about the insulating support *E* of the inner electrode, a slow current of pure dry gas through the inlet *G*. This is supposed to be supplied at a sufficient rate to prevent any diffusion or convection of the gas in the main chamber back into the constricted space *H*, the walls of which may also be made of insulating material. Another method, which may be used as an alternative or as an auxiliary to that just described, consists in heating the space *H* to such a temperature that deposition of the suspended matter, either in solid or liquid form, is impossible. In the drawing, the heating is shown as effected by a winding of wire *h*, through which an electric current is passed; but, any other suitable means of heating may be employed.

"The deposited matter may be removed from the precipitation chamber *A*, in any manner most convenient, the mode depending upon its character and amount. If liquid, it may be drained off from the bottom of the chamber. If solid, it might be flushed down and out with liquid, or scraped out as a solid. These processes might be intermittent or continuous.

"As previously stated, a direct current has decided advantages as a charging source for the electrodes, but its production by the usual means, at the potentials here desired, presents certain well known technical difficulties. For the production of an electric current of the relatively small magnitude actually demanded by the present improvement, the method illustrated in Fig. 1 has answered well, and has the great advantage of extreme simplicity, coupled with ease of installation and maintenance of the apparatus required. One of the active electrodes is permanently connected with one terminal of a high potential alternating-current circuit, while the other active electrode is connected with the other terminal of the same circuit through a make-and-break, operated in synchronism with the alternations of the circuit, and in which contact is made once each cycle, and only for a portion of each cycle. By properly choosing the points in the cycle at which the contact is made and broken, any differ-

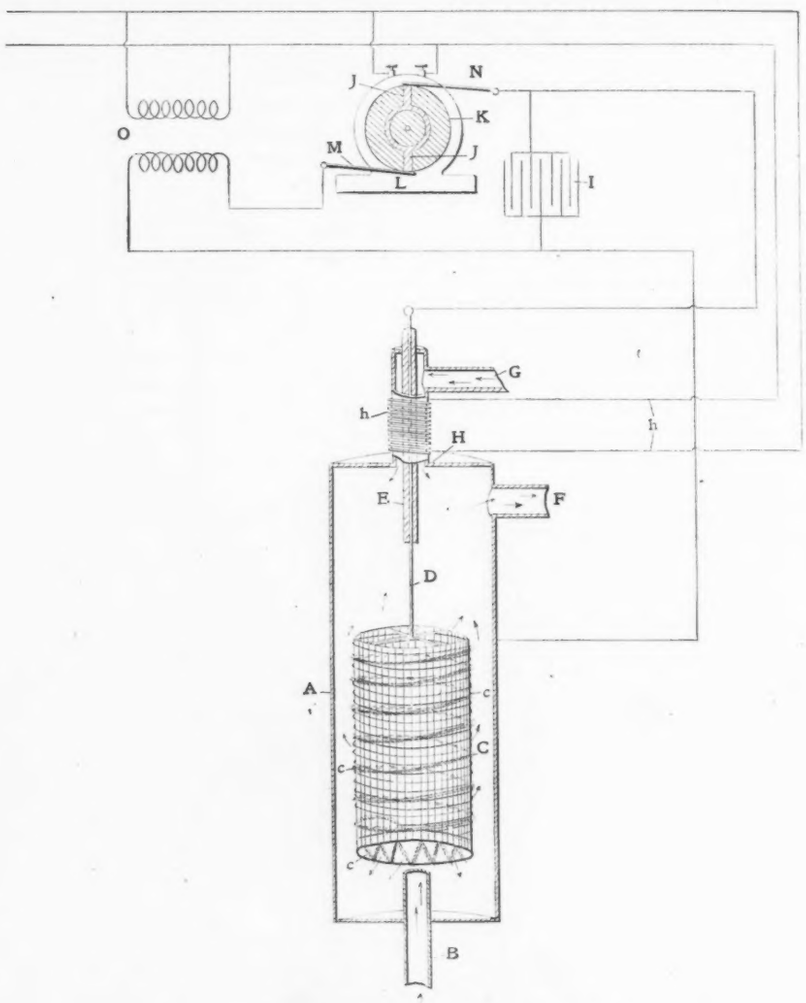


FIG. 1. GENERAL ARRANGEMENT OF APPARATUS

ence of potential may be impressed on the electrodes, from zero up to the maximum of the alternating-current line, without having to alter the latter at all. It is probable that in actual practice, the maximum will generally be chosen.

"In order to maintain the potential difference of the active electrodes nearly at its maximum during the portion of each cycle when the connection with the alternating-current line is broken, the condenser *I* may be connected in parallel with the active electrodes, thus increasing the capacity of the electrode system as a whole, of which it is to be considered a part. The electrodes, in themselves, constitute an air or gas condenser, and in some cases may suffice without the auxiliary condenser *I;* in any case, they supplement its capacity.

"A very satisfactory device for the make-and-break above referred to has been found in a system of metallic contact points *J*, mounted on an insulating disk or hub *K*, driven by a synchronous motor *L*, run by the same system of alternating current as that supplying the active electrodes, and by its rotation making and breaking contact between the brushes *M* and *N*. The arrangement of disk and contacts, shown in Fig. 1, assumes two complete cycles for each revolution of the disk, but, by a proper change in the number and position of the contact points and brushes, it may be adapted to any other whole number of cycles per revolution, and, if more convenient, the disk and contacts may be mounted directly upon or driven directly from the shaft of the alternating-current generator, which supplies the system. The synchronous motor, or the generator, as the case may be, will, in practice, most probably be operated at a lower voltage than that used for charging the active electrodes, this being indicated by the introduction of the transformer *O* between these two circuits.

"The above description serves to illustrate one of the simplest modes of carrying out my improvements. I shall now point out some of the modifications of detail which also fall within the scope of said improvements.

"It is possible to combine smooth with pubescent surfaces on the same electrode and retain the advantage sought, if the disposition of the smooth and pubescent areas on the two electrodes of opposite sign be such that nowhere are pubescent surfaces of opposite sign both discharging into the same region of gas. Fig. 2 serves to illustrate what is here meant. *A'* is a flue through which the gas is passing, and *B' B' B' B'* is an electrode, each of its four sections being made, for example, of two sheets of wire gauze, slightly spaced from each other, and the left-hand one only of each section having a pubescent surface, as shown. *C' C' C'* make up a corresponding electrode of opposite polarity. In each of the regions *a a a*, the gas and particles are being charged negatively, while in each of the regions *b b*, they are being charged positively, but, in no single region of any important extent are they receiving noteworthy charges of both signs.

"The relative motion between gas and electrode may, in some cases, be best produced by moving the electrode itself through the gas, as, for example, when treating air in the open, or any gas in very large chambers. A further extension of the same principle of electrodes shown in Fig. 1, is shown in the modified arrangement in Fig. 3. Herein is illustrated the surrounding of the active electrode *C* of Fig. 1, by a concentric cylinder A^2 of wire gauze or other suitable material, resting on the bottom of the main vessel *A*, and forming an extension of the inner surface of this vessel. Surrounding this again is another concentric cylinder C^2 of similar construction forming a part of the electrode *C*. The upper portion of the electrode *C* may be made solid, if desired, to still further guide the gas through the meshes of the several cylindrical shells. The principles of construction illustrated in Fig. 2 may, of course, also be combined with those of Fig. 3; and the number of concentric shells may be indefinitely increased. Both active electrodes may be connected and disconnected twice each cycle to the two terminals of the alternating-current circuit in such wise that their relative polarity remains the same. This has the advantage of utilizing both alternations of each cycle. For this purpose, the disk, brushes and connections may be modified in some such way as is shown in Fig. 4. Corresponding parts are lettered as in Fig. 1. A second system of contact points *J'*, similar to points *J*, is mounted on the opposite side of hub *K*, its contact points dividing the arcs between those of points *J* in halves; the systems of points *J* and *J'* being insulated from each other by hub *K*. The brush *N* makes permanent contact with points *J;* and brush *N'* with points *J'*. Brushes *M* and *M'* each make contact intermittently with points *J* and *J'*."

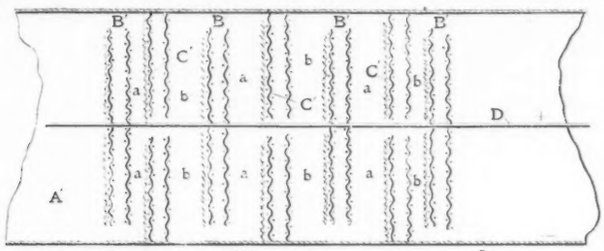


FIG. 2

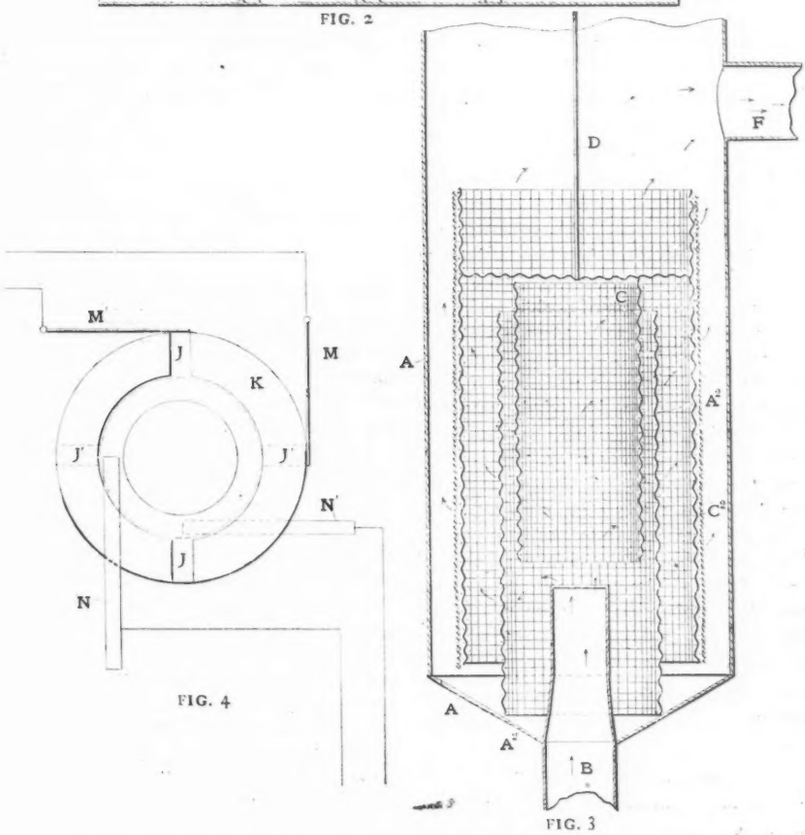


FIG. 4

FIG. 3

MODIFICATIONS OF THE ELECTRODES AND SYNCHRONOUS-CONTACT DEVICE

At the Ozark Zinc Oxide Works, Coffeyville, Kansas, a drum is used to mix the ore going to the Vezin sampler.

A New System of Modern Coke Ovens

Details of Construction and Operation Which Permit Saving By-products and Excess Gases. Discussion of Horizontal and Vertical Flues

BY F. FIESCHI*

The different kinds of coke ovens actually in use may all be classed as follows: First, ordinary coke ovens in which the gases produced by distillation pass straight from the oven into the pier to produce heat. The heat not absorbed by carbonization and which was formerly completely lost is now utilized for the production of steam. The construction of these ovens admits of no arrangement for the collecting of by-products and the gases in excess. This first type of oven has been almost abandoned, being only advantageous in small plants incapable of enlargement. In fact, the expense incurred in the construction of recuperative apparatus, is more in proportion, for a small number of ovens than for forty. Therefore, the sinking of capital is greater than the profit accruing from the recuperation. Twenty ovens can be considered as the minimum number, and under this, profit becomes doubtful.

The second class are the ovens for the recuperation of by-products. The construction of these ovens is such as to permit the products of the distillation of coal to pass through a combination of apparatus destined to condense the coal tar, to retain the ammonia (often also the light hydro-carbons and sometimes cyanides) before going into the piers to be burnt for the purpose of heating the oven.

After having heated the ovens, the hot gases produced by combustion escape the piers at a temperature of about 1000 deg. C. This heat, lost by the ovens, is used for heating the steam generators and these gases, when sufficiently cooled, escape by a chimney into the air. It is possible, in certain cases, with a sufficiently bituminous coal, to have excess combustible gases which constitute a profitable by-product.

The third class of ovens are those of recuperation with regenerators. This class of ovens works like those of the second class, except that the calories not absorbed by the heating of the oven, are not used for producing steam, but for heating the air necessary for the combustion of gas.

This operation is accomplished in chambers of fire-brick filled with bricks, piled in a special manner, receiving alternately hot gas and air. This method of procedure is comparable with the reheating of air-feeding blast furnaces.

In this manner the greater part of the calories carried away by the products of the combustion of gas are restored to the burning elements. The immediate advantage of this method of operation is to render available a large quantity of gas produced by the distillation of coal. This method permits equally the transformation into coke, of coal which, while possessing sufficient coking qualities, does not furnish by distillation in a closed chamber, a sufficient quantity of gas to maintain the ovens of the second class at the temperature necessary for carbonization.

The excess gases, which in ordinary recuperative ovens are seldom more than 20 per cent. of the total, increase with ordinary coking coal, to 40 per cent. and sometimes exceed 50 per cent. with coals of a bituminous character.

Superiority of the Ovens with Regenerators. Demonstration by Calculation

It is easy to demonstrate by a simple calculation, the superiority of ovens with regenerators to ovens with ordinary recuperation. Take, for instance, a battery of ovens with recuperation carbonizing an average of 300 tons of coal in 24 hours. The production of gas per ton is equal to 250 cu.m. and all this gas freed from by-products, tar, light oils and ammonia, is necessary for the heating of the ovens.

The heating power of this gas has been found equal on an average to 3800 cal. per cu.m. (air at 0 deg. C. water non-condensed). The combustion requires practically 4.9 cu.m. of air to the cubic meter of gas, and this combustion produces 5.8 cu.m. of gas. The 5.8 cu.m. proceeding from the combustion of 1 cu.m. of gas, leave the piers at a temperature of 1090 deg. C.; they carry off, therefore:

$$0.33 \times 5.8 \times 1070 = 2048 \text{ cal.}$$

and the heat given to the oven is, therefore:

$$3800 - 2048 = 1752 \text{ cal.}$$

These gases are partially cooled in passing under generators of steam, then escape to the atmosphere by a chimney.

The temperature of the gases on leaving the generators being 250 deg., the loss of heat is equal to

$$0.33 \times 5.8 \times 250 = 478 \text{ cal.}$$

The 3800 cal. produced by the combustion of 1 cu.m. of gas are, therefore, divided in the following manner:

	Calories.
1. Heating of the ovens	= 1752
2. Heating of the boilers	= 1570
3. Losses by the chimney	= 478
Total	3800

For the entire battery the production of gas is

$$250 \times 300 = 75{,}000 \text{ m. cal.}$$

which, in burning, furnish:

$$3800 \text{ cal.} \times 75{,}000 = 285{,}000{,}000 \text{ cal.}$$

distributed in the following manner:

	Calories.
1. Heating of the ovens, $1752 \times 75\,000$	= 131,400,000
2. Heating of the boilers, $1570 \times 75{,}000$	= 117,750,000
3. Losses by the chimney, $478 \times 75{,}000$	= 35,850,000
Total	285,000,000

Observe, in passing, the poor output of ordinary ovens not utilizing lost heat. These ovens losing, in fact, more than half the heat developed by the phenomenon of carbonization. Taking 1.80 as the coefficient of utilization of heat in the generators, the production per 24 hours of steam at 10 kg. (feeding water at 35 deg.) will be:

$$\frac{117{,}750{,}000}{606.5 + 0.305 \times 179 + 35} \times 0.80 = 150{,}455 \text{ kg.}$$

which when utilized in perfected steam engines consuming 6 kg. per horse-power per hour, will produce a power of:

$$\frac{150.455}{6 \times 24} = 1044.8 \text{ h.p.}$$

Let us suppose, now, that the system of regenerators is applied to this battery. The gases, leaving the piers at 1070 deg., pass into the regenerators, and leaving there a part of their calories, escape into the chimney at a temperature, which to correspond with the above, we will suppose is equal to 250 deg., a result which is always possible to attain.

The 1570 cal., serving first for heating the generators will be restored to the air necessary for combustion and will assist in the heating of the ovens, by means of the brick pilings. The quantity of the heat furnished for this purpose by the combustion of 1 m. cal. of gas will be:

$$1752 + 1570 = 3322 \text{ cal.}$$

and the loss by the chimney will still remain 478 cal., since the gases enter the chimney always at the same temperature, namely 250 deg. We have seen above that for the carbonization of 300 tons of coal it is necessary to have 131,000,000 cal., consequently the quantity of gas necessary for the whole battery for 24 hours will be:

$$\frac{131{,}000{,}000}{3322} = 39{,}544 \text{ m. cal.}$$

and as the production is 75,000 m. cal., there will be,

*Mining engineer, 125 Avenue La Septembre, Douai, France.

$75{,}000 - 39{,}554 = 35{,}446$ m. cal. of gas in excess.

If this gas is employed for heating the boiler, it is clear that the same motive power as above will be produced, since the total quantity of heat generated will be the same, and the same quantity of hot gases must be allowed to escape to the air. The installation of regenerators would occasion useless expense, and would only become advantageous if it were desired to heat generators at a great distance from the battery, gas being much more easily transported than steam, and the losses occasioned by condensation avoided.

It is, however, not the same, when gas motors are used. According to the opinion of experts in this matter, it is necessary with a gas motor to have per horse-power, and per hour, a quantity of gas able to produce by its combustion 3300 cal.; consequently the power, which can be produced by the means of this excess of gas will be:

$$\frac{35{,}446 \times 3800}{3300 \times 24} = 1700 \text{ h.p.}$$

instead of 1045 obtained by the means of steam; the increase is, therefore:

$1700 - 1045 = 655$ h.p., or say, 62.78 per cent.

Observation on the Use of Regenerators

By the preceding calculations we have seen that if circumstances correspond on all points, it is the use of regenerators combined with that of gas motors which enables us to obtain the maximum of motive power with coke ovens; we therefore have a right to inquire why this system which was applied nearly 20 years ago, has been subsequently almost abandoned, and has only been revised in recent years. It is true that G. Hoffman (1884) constructed ovens, in which gas and air were heated in recuperators. The heating of gas had great drawbacks: Dissociation of its elements, danger of explosion, and also, with each reversing, there was a loss of gas equal to the capacity of the recuperator; thus the heating of gas was soon abandoned, as the volume of air was equal to five or six times that of the gas.

The construction of this oven in which the air alone is heated, and whose working was satisfactory, has not become general, because the utilization of these gases with high-heating power was difficult; the question of the high-power motors for rich gas not having been solved.

At the present time this is no longer the case, and this problem appears to be understood. In the beginning of 1906 there were divided among different coal mines in Germany, either working or in construction, 35 motors operated through the use of gas from coke ovens; these motors were capable of producing a total of 30,000 horsepower.

The superiority of ovens of recuperation and regenerators is, therefore, incontestably proved, and with these results before us, we have every reason to believe that the construction of this class of ovens will become more and more general.

Conditions that Must be Filled in the Construction of the Coke Oven

These conditions are of two kinds, according to the point of view taken into consideration; that of recuperation, or that of the coke produced. The quality of coke produced is most important, and should be considered first, as coke is the principal product.

If we are given a coal that is destined to be carbonized in a specified time, that which should be required of an oven is the production of a coke which will be

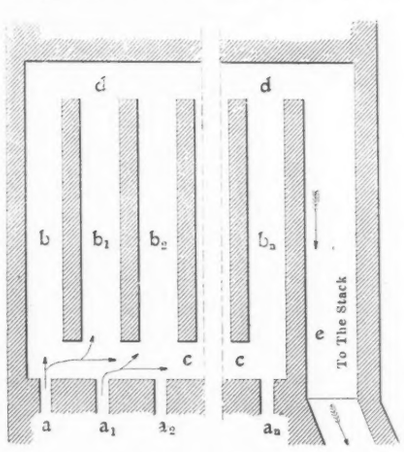


FIG. 1. THE GASEOUS CURRENT TAKES SHORTEST ROUTE

neither under, nor over-carbonized; all other qualities (hardness, density) depend solely upon the quality and the constitution of the coal used. It is not necessary to take the output into consideration. It is sufficient, in order to attain the maximum, that the construction and the management of the ovens be exact and careful, in order to avoid air entering which would provoke combustion of part of the coke. These conditions of good working are realized by regular heating and by a correct temperature of all the walls.

Uniformity of Heating

Uniform heating is obtained, first, by driving the entries of air and gas equally over a large number of points, throughout the hight of the pier; second, in shortening as much as possible the distance traversed by the gas for combustion, which latter, though quick at first, rapidly becomes slower; third, in preventing burning gases from taking another route than that marked out for them; this is, in order that each elementary surface of the wall may come into contact with the same quantity of gas.

Let us see in what manner these three conditions are realized in the present ovens: I will speak only of horizontal ovens called the Belgian two-door ovens; all other types having now fallen into disuse. These ovens may be divided into two classes: Ovens with horizontal flues, and ovens with vertical flues, both working with or without recuperation.

Ovens with horizontal flues have only been revived because they lend themselves more easily to recuperation; they do not fulfill the two first conditions enumerated above. The admission of air and gas being made horizontally cannot be equally divided over a large number of points, and the gases pass through from 10 to 20 or 25 m. before reaching the hearth of the oven.

Experts have tried to remedy this by dividing the entry of the combustible matter over the whole of the distance, by means of special little conduct pipes. This proceeding complicates the construction of the oven considerably, the conduct pipes become easily stopped up, also the incomplete combustion of the gas at the beginning provokes dissociation of the gas, from which there results a deposit of lamp-black, and consequently dimunition of the calorific power of the gas. Furthermore, these deposits cause dimunition of the conductibility of the bricks, and augumentation of resistance to the flowing of the gases in the flues. As to the third condition, it is for the most part realized.

Ovens with vertical flues without recuperation (such as those constructed by Coppee & Bernard), fulfil almost completely the three conditions given above; coke manufacturers agree that the best coke is obtained with these ovens.

If we consider the different types of ovens with vertical flues and with recuperation, in use at the present time, it is easy to see that if the first condition is realized, the second is only relatively so, and the third is not fulfilled at all.

These latter ovens have a certain number of vertical flues communicating at one extremity, and more often at both, with a horizontal flue, so that instead of dividing itself equally among all the vertical flues, the gaseous current tends to take the shortest route, thus certain flues become overheated, while others are scarcely heated at all. It is this which is shown, in the diagram, Fig. 1. The combustible mixture arriving in some way by a, a_1, a_2, instead of ascending while burning, into the corresponding vertical flues b, b_1, b_2, tends to follow the routes indicated by the arrows, in such a way that these flues become hotter in the proximity of c, and at the beginning are scarcely heated at all.

In the arrangement represented by Fig. 2, this disadvantage is shown more clearly still. The gases hot or in combustion enter the flue C, following the arrows, and should divide themselves equally amongst b, b_1...., to escape afterward by a, a_1,...., but that which actually

occurs, however, is this; the greater quantity passes by the flues on the left, while the more distant flues on the right receive scarcely any at all.

Inventors have tried to remedy this defect placing a small dumper to each vertical flue, this dumper enabling the section to be narrowed more or less. But, owing to the difficulties due to the inaccessibility of the dumpers, and to the exactitude, which this operation requires in order to be efficacious; this regulating, though theoretically good, is in practice quite fallacious, and only complicates the construction of ovens.

Conditions From the Point of View of Recuperation

Conditions with reference to recuperation should be such that the ovens, which fulfill them, give a maximum output of by-products, including gas in excess. To obtain the maximum of gas in excess, it is obviously necessary to produce the smallest consumption possible, which is done when the conditions before enumerated are fulfilled. For the other by-products, the only thing which must be required of the oven is, that the gases of distillation shall not be over-heated (as is the case with most of the current systems) in order to avoid harmful dissociations.

A factor which plays a part in the output of by-products is the temperature of the distillation, but this concerns more particularly the management of the ovens, and depends upon the manner in which they are regulated. The discussion of this question would, therefore, lead us beyond the limits of this article.

Regulating the Ovens

Whatever point of view is taken, it is evident that the regulation, that is to say, the quantity and proportion of air and gas admitted, can be performed in a satisfactory manner. This regulating is easy to effect and to control in ovens having horizontal flues, but it becomes difficult in ovens with vertical flues.

Conclusions

If we consider the ovens in actual use, we see that: Ovens with horizontal flues, although simple to manage and to regulate, are inferior in the quality of coke produced and for the output of available gas, owing to the inequality of the treating of the walls. Ovens with vertical flues without recuperation, are easily worked and give the best coke (consequently uniformity of heating). Ovens with vertical flues and recuperation, while realizing important advantages, are difficult and complicated, if not impossible to regulate, and are far from having the uniformity of heating.

We saw at the beginning of this article that three different classes of coke ovens can be recognized, each class including a large number of different systems; generally ovens with recuperation can be worked without recuperation, and must so be operated in order to set them in motion. This working is always conducted under unsatisfactory conditions and cannot last long. When ovens have been operated for a certain time a change of system can only be effected after considerable expense.

In summing up the various systems of ovens in use, there is none which possesses the property of working satisfactorily in all the three different ways, with the same perfection; that is, first, without recuperation; second, with recuperation; third, with recuperation and regenerators. The absence of ovens capable of working in three ways is a serious disadvantage, since all the ovens so far constructed must operate in one manner only.

In order to appreciate the advantages, which such a system would offer, let us

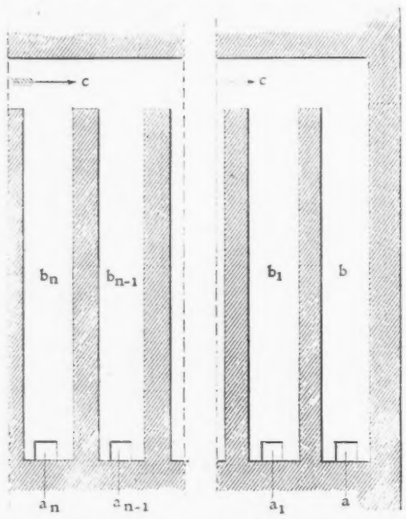


FIG. 2. SHOWING POOR ARRANGEMENT OF FLUES

imagine a company with limited means and having decided on (a case in point at this moment) the reconstruction of a certain number of ordinary ovens which have been given up. Recuperation must be abandoned, and thus the lost flames will serve to produce steam by means of the existing generators. The by-products should be collected by constructing the necessary plant (when resources permit). Then, little by little, battery after battery, in proportion as the various machines become insufficient or out of order, working with heated air can be adopted, and steam machines will be replaced by gas motors. Besides, if the steam machines are maintained, they could, in case of need, serve as auxiliaries, since it would suffice to again resume working without heating the air, to bring the boilers back into pressure.

The New System of Coke Ovens

In this new type of oven (Figs. 3, 4, 5, 6 and 7), each pier is composed of 32 vertical flues forming 16 groups of two flues g and h, which communicate with one another at the top part by the conductor w and at the lower part by means of the flues f and f'; the regenerator i is placed directly under the oven. These regenerators are alternately brought in connection by v and k with two large flues l, placed along the battery in front and behind and communicating either with the chimney or with the atmosphere. At the top of each of the 32 vertical flues there is a conductor a, which acts as a gas burner and is closed at the top by the stopper a^1. By this arrangement the inside of the flues can be examined, so that the regulating may be ascertained.

These burners can communicate, first, with the pipes r that serve for the return of gases when cleared of the by-products by means of the pipes m and n. This system of pipes is arranged in such a manner that the burners of the odd row have a feeding absolutely independent of that of the burners of the even row; second, they can communicate with the interior of the ovens by means of the holes c^2 for the two extreme burners, and by means of the holes c and c^1 for the others. These latter run alternately into the ovens on the right and on the left. This communication which is direct for the other burners, is established through the medium of the little conducts f and f^1 for the others. A stopper d is placed so as to establish or cut off this communication. A second stopper d^1 shuts off the communication with the outside.

Each set of two flues can, moreover, communicate directly with the air by means of the stopper b. The stopper b^1 may then be replaced by a metallic plug (which is not described in the accompanying drawings), which serves to regulate the inflow of the fuel.

Working Without Recuperation

The stoppers d being taken away and the holes c^2 opened (which can easily be done when the oven is open), the gas proceeding from the distillation passes from the oven into the burners a, as remarked above. The sections of the orifices are so calculated as to give admittance to the gas in a ratio which increases as we go further from the axle of the battery, so as to take into consideration the cooling of the farthest ends of the oven caused by the surrounding air. The stopper b having also been taken away, the air, the entering of which can be regulated by the plug replacing b^1, comes in at w and is divided equally between g and h. The combustion begins, therefore, by the conic extremities of the burners, and the products of the combustion, induced by the draft of the chimney, reaches the lower part where the combustion must be complete and hence they go by j and j^1 the regenerator i, and the flue k to the great pipe L and then to the chimney. The

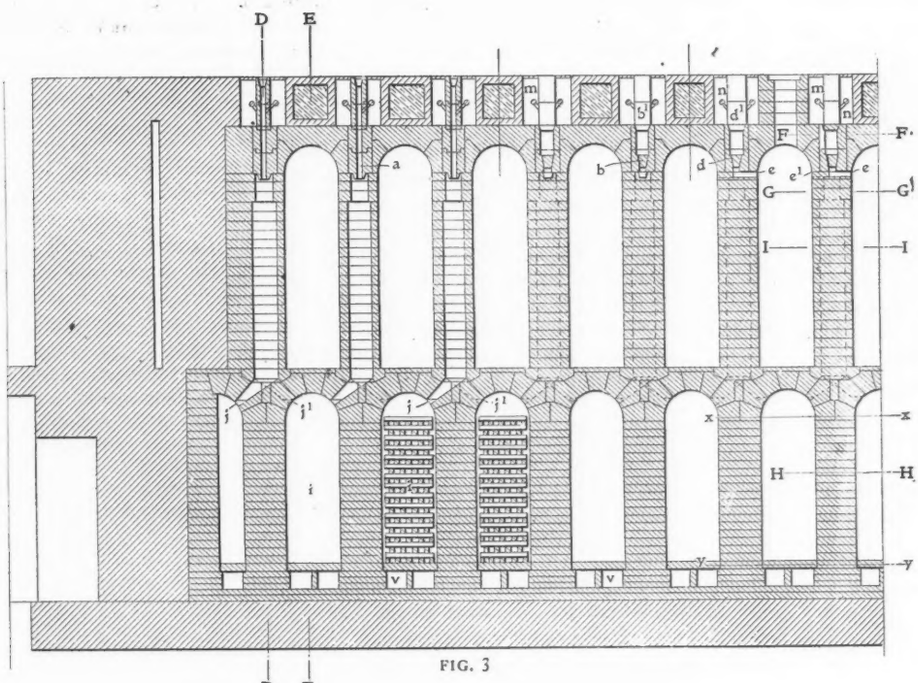


FIG. 3

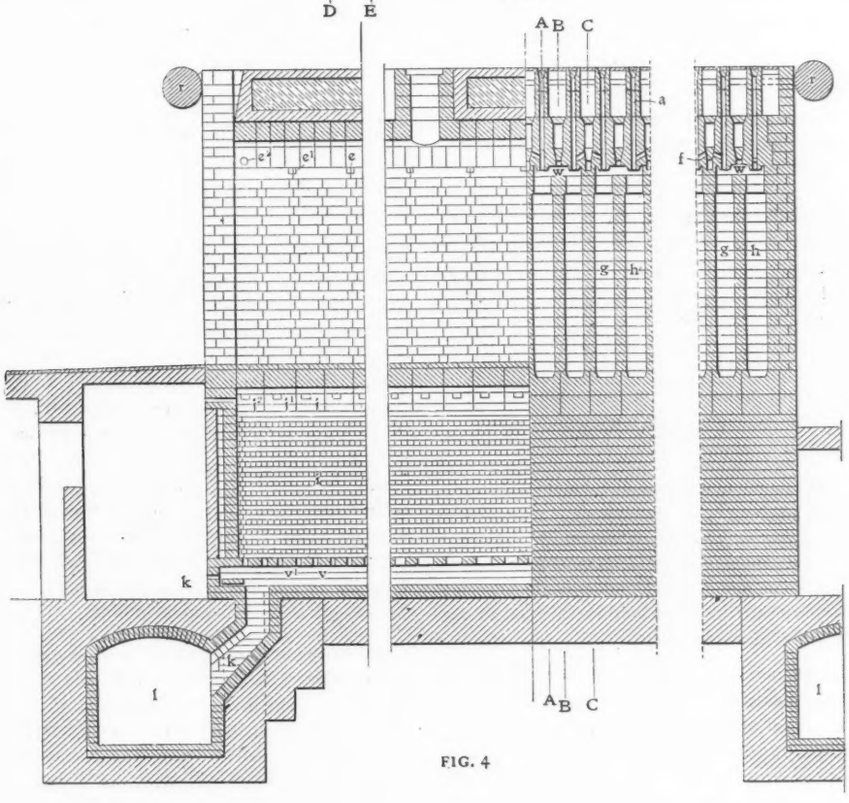


FIG. 4

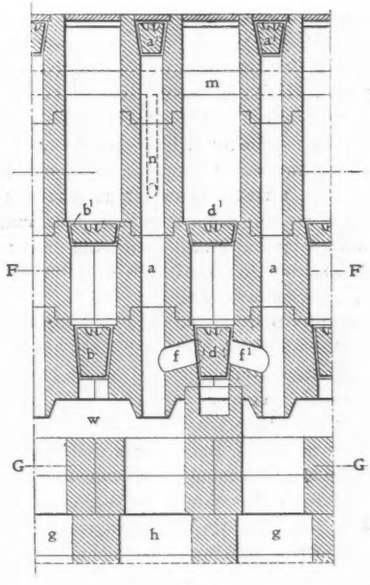


FIG. 5

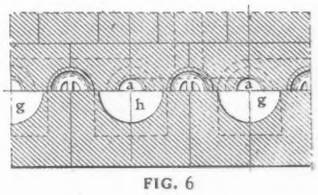


FIG. 6

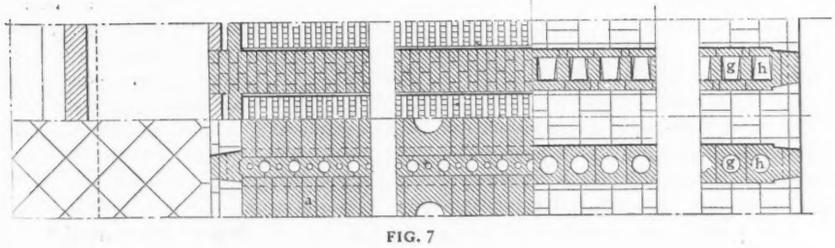


FIG. 7

SECTIONAL VIEWS SHOWING GENERAL CONSTRUCTION SCHEME FOR A NEW-STYLE COKE OVEN

LEGEND.

FIG. 3. Longitudinal Section on Lines A-A, B-B and C-C of Fig. 2.

FIG 4. Transverse Section on Lines D-D and E-E, Fig. 1.

FIG. 5. Transverse Section on Line E-E, Fig. 1.

FIG. 6. Horizontal Section on Lines F-F, Figs. 1 and 3.

FIG. 7. Horizontal Section on Lines P-F, H-H, G-G and I-I, Fig. 1.

draft is regulated for each pier by means of the dampers k^1.

For each of the 32 flues, the draft is regulated by the construction of the oven, in giving to the sections of communication j and j^2, variable values in connection with the equality of gas allowed in a and with the distance that the gases must run over, into the regenerator, to attain the outlet k.

Operating with Recuperation of the By-products

The stoppers d and d^1 are carefully luted, as also are the stoppers of the holes e^2. The gases coming out from the recuperation feeding all the burners a and the air necessary to the combustion, continue to come on as in the working described in the preceding paragraph. This being stated, the course of the gases and the heating take place as before outlined.

Working with Recuperation of By-products and Heating the Air

The stoppers b, b^2, d, d^1 are placed and carefully luted. The combustible gases enter as in the preceding process, but in consequence of a set of plugs, only the burners of the even row are fed during 20 min.; then for the following 20 min. the contrary takes place. At the same time, as this change occurs, one of the large canals l which was in communication with the chimney is put into communication with the air, while it is the contrary that takes place for the other canal. The automatic gearing which produces this working, is regulated in such a manner that when a set of burners receives the gas, the 16 vertical corresponding flues communicate by j, i, k and l with the chimney and the other 16 flues by the same medium communicate with the air.

Therefore, if the burners in connection with the 16 flues h are fed, the draft of the chimney will produce a current of air which, coming in by l, will travel across the regenerator, and being heated, will go up the 16 flues g and distribute to ignite the gas coming at the top of the 16 flues h. The product of the combustion will then go into the chimney through the regenerators, which will be reheated so as to abandon part of their heat to the air, which will go through them during the 20 min. that follows. During this time the same cycle will be produced anew, but inversely, and so on.

Advantages of the System

This oven, as it appears from the preceding explanations, allows the following conditions to be realized: First, it keeps a free vertical descent for the gases and divides them among numerous flues. The advantages of such an arrangement has been recognized and has been long employed in ovens working without recuperation. Second, it forms a unique type of oven, able to work indifferently either with or without recuperation, and in case of recuperation, with or without heating of the air by means of regenerators. Third, absolute uniformity in heating, the piers being made of 16 independent elements, each of two flues, gas and air arriving in each element, serving solely for heating the two flues; it is impossible for the gaseous current in all its course and whatever may be the operation, to follow any other course than that which has been laid out for it. The circuit of the gases is reduced to the minimum of length, since it is only equal to the hight of the oven. This circuit of gas attains a length three or four times greater in ovens with vertical flues and 10 or 12 times more in ovens with horizontal flues. The gases coming under the hearth, are completely burned, and the hearth is not heated to a high temperature. It is nearly certain that an output of free gas exceeding the quantities obtained with the usual types of ovens, is obtained with such an oven.

Fourth, easy regulation and control, also easy passage from one operation to another. These operations being executed above the oven and in free air by means of stoppers which are easily managed.

The coming in of the gas forming reversed burners makes all obstruction impossible, and the waste falling into the flues during the construction reaches the regenerator, or the flues which replaces it, from which it is extremely easy to remove. Furthermore, from the point of view of construction, the absence of horizontal flues running the whole length of the pier, and which are to be met with in all ovens with vertical flues, sometimes above, sometimes below, increases greatly the solidity of the piers.

Colliery Notes

It is estimated that the total amount of coal in North China, which is considered the largest Chinese coalfield, is 605,000,000,000 tons, which is 45,000,000,000 tons less than the United States government's estimate of the total amount of coal in the Appalachian fields.

The newly patented Shedlock process of manufacturing briquets consists of a combination of tar distillation and the consolidation of small particles of waste coal of all kinds into dense blocks of fuel, smokeless and possessing a high calorific value. The process consists in first effecting a perfect mixture of the small particles of coal with any suitable tar; each particle is covered with a thin film of tar. The quantity of tar used depends entirely upon the nature of the coal, in any case not exceeding 6 per cent. of the whole. The prepared materials are then automatically and continuously fed into and pressed in thin layers through a heated machine, where the fuel materials are raised to such a temperature as to separate the oils from the tar, which are withdrawn and condensed. The thin film of pitch deposited on each particle of coal is the adhesive substance which under pressure binds the material into blocks more homeogenous and harder than the coal used in their construction.

Figures recently submitted by the coal-carrying railroads in the commodity-clause suit, give some interesting facts relative to the distribution of anthracite coal. They show that nearly half of the entire production of the anthracite mines is consumed in the States of New York and Pennsylvania, and all but 10,000,000 tons are consumed in the Eastern States. The figures were based on the 1905 market and are representative in every respect.

Pennsylvania	11,520,883
New York	18,125,419
New England States	8,692,504
New Jersey	7,212,341
Western States	6,904,314
Supply to railroads	4,643,426
Canada	2,187,450
Southern States	2,080,078
Pacific Coast	1,743
Foreign countries	42,533

The size of mine timbers may often be materially reduced if they are kept sound, as then no allowance in size has to be made to offset decay.

When about to treat pine timber with a preservative, remember that absorption is more easily controlled by varying the length of the cold bath than by variation in the length of the hot bath.

Mine ladders should be strong and set on an incline if possible, for when so placed they are much easier to climb, and there is less danger of accidents from slipping than when ladders are set vertically. The rungs should be set at equal distance from each other and should never be allowed to remain broken or cracked for any length of time. Vertical ladders should be fitted with trap doors at frequent intervals. All ladders should be securely nailed to the uprights. Metal ladders give good use in mines free from acid water, though there is more danger of slipping than with wooden ladders.

The superior points of the new German steel bands which are used in place of leather belting are: On account of its solidity, a much narrower band can be used, one-sixth of the width of the usual leather band being sufficient; as a result of this, the steel band is not as heavy as the customary leather band, and it can be tightly adjusted; the distance between the engine and the machine is not of such vital importance as where leather belting is used, and the transmission of power depends upon the weight of the hanging belt; the slipping is much reduced. The entire loss of power is small, and will not exceed 1 per cent. Because of the lightness of weight of the steel belting, the influence of the centrifugal force is not so great and allows of an increase in velocity.

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August 15	9,500
August 22	9,500

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
The Mineral Industry—Vol. XVI. 383
Zinc Mining in the Joplin District 383
The Price of Silver 384
*The Hematite Mines of Cumberland, England ..... *Lucuis W. Mayer* 357
Short Talks on Mining Law.—VIII. *A. H. Ricketts* 363
Back-stoping vs. Underhand Stoping in Large Bodies of Iron Pyrites. *J. J. Rutledge* 365
*The Ore Deposits of Magdalena, New Mexico ..... *Philip Argall* 366
Mining Lode Tin in Malaya. *Special Correspondence* 371
Mount Lyell Mining and Railway Company. 372
Electrolytic Determination of Zinc 372
*Smelter of Penoles Company, Mapimi, Mex.—II ..... *Claude T. Rice* 373
*Cottrell Process for Condensing Smelter Fumes ..... *Special Correspondence* 375
*A New System of Modern Coke Ovens. *F. Fieschi* 378
Colliery Notes 382
Correspondence:
Geological Mapping of Mine Working. *J. H. Farrel* 385
The Proposed New Mining Law in Mexico. *Geo. A. Packard* 385
Analysis of Roman Bronze. *Geo. W. Maynard* 386
Operating Costs, Homestake Slime Plant. *C. W. Merrill* 386
Effect of Discharge Level and Water Supply on Stamp Capacity 386
Sloss-Sheffield Steel and Iron Company 387
Iron Production in Canada 387
New Mineral Products in California. *Special Correspondence* 387
Personal, Obituaries, Societies and Technical Schools 388
Special Correspondence 389
Mining News 391
Markets, etc 396
*Illustrated.

The Mineral Industry, Vol. XVI.

The sixteenth volume of "The Mineral Industry" will be published about Sept. 10. This is a little later in the year than the appearance of Vol. XV, but there have been some unavoidable delays this year which it is hoped to overcome in future years; and also the forthcoming volume is considerably larger than any of its predecessors; but even so, the forthcoming volume is not much belated. Its price will be $10, instead of $5 as heretofore. It is fitting to offer a word of explanation with respect to this increase.

Fifteen volumes of "The Mineral Industry" have been published at a financial loss. The sale of each volume has been large, but the cost of production is inevitably so large that a greater sale than has heretofore been achieved is necessary to make the publication pay its way. Obviously unless that be accomplished, the publication cannot be expected to continue.

We feel confident that this frank statement of affairs will lead to the increased co-operation that is necessary. Many engineers who are conversant with the facts have expressed to us the opinion that the suspension of "The Mineral Industry" would be a serious loss to the profession. During the 16 years of its existence it has been recognized as the only universal source of information respecting matters connected with the statistics, technology and trade of mining and metallurgy. In looking for data pertaining to such subjects, it is the first reference book to which the mining and metallurgical engineer turns; similarly with the teacher and student, with the merchant and banker, and indeed, with all concerned in the great industry of which it is the exponent. If there were no "Mineral Industry" there would be a serious absence of ability to obtain its mass of absolutely necessary information.

Few appreciate the great expense and enormous concentration of effort involved in bringing out a volume of "The Mineral Industry." The average scientific or technical treatise is a work of about 400 pages, with about 400 words to the page. From the time when the manuscript is received from the author to the time of the publication of the finished volume, there is usually a period of six months. "The Mineral Industry" is a volume of upward of 1000 pages, and 500 words go to the page. Its publication is executed in the period of six to seven months, which includes not merely the putting of the book through the press, but also the preparation of the entire manuscript and the collection of its multifold statistics, the latter work alone involving the writing of thousands of letters and telegrams and the co-ordination and tabulation of the statistical reports. "The Mineral Industry" is not merely a valuable contribution to commercial and technical knowledge; it is an institution of international importance and benefit; yet many who ought to support it have failed to do so. Its future will depend largely upon the support that it receives this year. Even at the new price of $10 it must have the active coöperation of many professional men. We feel confident that it will receive this necessary support.

Zinc Mining in the Joplin District

A subject that is especially engaging attention in the Joplin district is the organization of an effort to secure the imposition of a tariff on zinc ore at the next session of Congress. In several of the towns of the district zinc-ore tariff clubs are being formed. The purpose is to effect the exclusion of Mexican ore and thereby elevate the price of American ore by reducing the supply that heretofore has been available to the smelters.

It is obvious that such an arbitrary restriction of ore supply would increase the price of domestic spelter within certain limits, and would correspondingly increase the price of domestic zinc ore. The bill would be paid by the consumers of spelter. During the last 12 months this scheme would not have worked successfully, because the consumers have not wanted to buy much spelter, and the offering of the metal at comparatively low prices has not prevented the accumulation of a large unsold stock, which still exists. However, under the stimulus of a revival in business, a restriction of the output would naturally have the effect of advancing the price more rapidly and higher than otherwise. But there would be a limit to such an advance at the point where it would become profitable to import spelter and at the point where many consumers would be led to abandon the use of zinc and employ cheaper substitutes.

The smelters are naturally opposed to any movement in this direction. Theoretically the smelter is a middleman, who does not care whether the price for spelter be high or low, provided he is able to realize an adequate margin. Practically, the smelter prefers a high price to a low price, because under the former condition his margin is generally larger. However, the smelters who have large investments in plant cannot contentedly look forward to the creation of high prices by artificial methods which would restrict their ore supply and put a large part of their plant out of business. Even under the boom conditions of the first half of 1907 there was at the end of that year a great surplus of smelting capacity.

This last condition would also tend to reduce the advantage resulting to the miners from an arbitrary elevation of price. The cost of smelting rises rapidly according as the smelting works falls short of operating at full capacity. The Western smelters in 1907 used about 551,000 tons of ore, of which about 110,000 tons were obtained from Mexico and Canada. If they were deprived of the foreign ore, the logical expectation would be a scramble for the diminished supply, an increase in the average smelting cost, an elimination of the less favorably situated concerns, a reduction in the smelting capacity, and finally the victors in possession of the field, with the ability temporarily to dictate terms, would undoubtedly direct their attention toward recouping previous losses during a brief period of large profits, which in themselves would induce new competitors to enter the business. The imposition of a tariff on zinc ore would not present a happy prospect to the Western smelters.

On the other hand, it is to be recognized that the present lot of the miners in the Joplin district is not a comfortable one. A large proportion of the mines are still idle, unable to work profitably under present conditions. This results from the reduction in the average grade of the ore mined in the Joplin district during the last four or five years. The old pocket deposits, which as recently as six or seven years ago were furnishing the bulk of the district's production from ore yielding upward of 5 per cent. mineral, have gradually given place to the sheet-ground mines, which yield but 3 per cent., or less, of mineral. In the meanwhile, royalties have not been materially reduced, and no concerted effort has yet been made to effect a readjustment in that particular. It is commonly overlooked that while the operators in the Joplin district may be only playing even, the district as a whole is nevertheless profitable, but the profit is all going into the pockets of the fee-owners. To impose upon ore that is worth only $1.15 to $1.40 per ton, as it is raised from the mine, a royalty of 10 per cent. and upward is a burden that few mines, anywhere in the world, can stand.

In spite of the low prices for ore that have prevailed during 1908, the shipments of zinc ore from the Joplin district during the first 31 weeks averaged nearly 4600 tons per week, or at the rate of nearly 240,000 tons for the year, which is less than 20 per cent. falling off as compared with 1907. This is surprising in view of the large number of mills that anyone can see to be idle. The explanation that is offered is that many of the men who have lost their company employment have gone to mining on their own account in the old diggings, and in this way are producing a good deal of ore in the aggregate.

The Price of Silver

The decline in the price of silver, to which reference was made sometime ago, has continued, with only occasional reactions. Silver has been between 55 and 52c. per ounce in New York since April, and last week a still further decline set in in which has carried the price down to 51c. in New York and 23½d. in London, with some signs of further decline. This is almost an approach to the lowest price on record, which was reported over five years ago. In January, 1903, the average prices for the month were 47.57c. in New York and 21.98d. in London. From that there was a gradual recovery until in April, 1903, the average was 50.56c., New York, and 23.38d., London, or not far from the current quotations of the present week. Since that time there has been a large appreciation in values, the highest point having been reached in November, 1906, when the averages were 70.813c. in New York and 32.671d. in London.

So far as this country is concerned, exports have not been at all reduced by the low prices as might have been expected. For the seven months ended July 31 the total exports of silver from the United States were valued at $35,174,251 in 1907, and $30,445,291 in 1908. This is a decrease of 13.4 per cent.; but owing to the lower prices ruling this year these values indicate an actual increase in quantities, from approximately 52,200,000 oz. in 1907 to 56,850,000 oz. this year, a gain of 8.9 per cent. These exports, it must be remembered, include a large quantity of foreign silver refined here. The exports of refined silver this year exceeded the imports in bullion and other forms by approximately 9,800,000 oz. only.

The key to the present situation is to be found, as usual, in the conditions in the Far East. The shipments of silver from London to the East in the seven months ended with July fell in value from £7,768,426 to £5,604,403, a decrease of 27.8 per cent. Here, as above, the difference in quantities varied from that in values, owing to the lower prices this year. The approximate quantities were 59,900,000 oz. in 1907, and 53,500,000 oz. in 1908, a decrease of 10.7 per cent.—quite enough, with an undiminished supply, to make a weak market.

The chief decrease has been in shipments to India, where unfavorable crops and consequent general poverty resulted in a smaller demand both for coinage and for private use. China took a considerable quantity early in the year, but has since been a seller rather than a buyer of silver; while the Straits Settlements have been almost entirely out of the market. The East absorbs so large a proportion of the world's silver production that its influence in the market cannot fail to be predominant.

Some minor causes, however, have aided in the fall. The demand for silver for use in the arts has been light, owing to the general business depression. Purchases of silver for coinage in Europe have been light, France and the other countries in the Latin Monetary Union placing only small orders. The United States Mint bought about 5,000,000 oz. early in the year, but has been entirely out of the market since April. All of these have helped in the depression.

A better account of the rains and crop prospects comes from India, but the effect will not be felt for some months to come, so that low prices will probably prevail for a time. The position of silver is peculiar, in that its production is so largely in connection with that of other metals.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Geological Mapping of Mine Workings

The practical value of geology is being more fully realized among mining men every day, but the geologist is still regarded by many practical miners as a person who "can't see any farther into the ground than any one else." The inference is that there is a good deal of bluff to be credited to the geologist. The first man who took a transit underground to do exact work, and who drew accurate maps of his mine, may have been looked upon in the same light. I should like to point out, in a very general way, why geological work is of value more directly than from a complex scientific standpoint.

If a map showing the relations of underground workings is valuable, even indispensable, in conducting mining operations, why should not a map bringing out geological features be of use? When you see the various pieces of a picture puzzle scattered before you, your idea of the whole is necessarily vague. So it is with the facts of underground geology; not until the scattered bits of evidence are collected and presented in concrete form, can you grasp the true conditions and connections. But when this has been done you may even be able to imagine the missing portion of the picture to find the orebody sought for. A method of exploration or development based on an abstract idea of the nature of a deposit is merely a step better than a purely haphazard scheme.

If the thing can be put on a more certain basis, how is it to be done? For the most part by plotting to scale on maps of the mine levels such geological features as may be ascertained by a reasonably careful examination of the workings. In general a map should show the size and shape of the deposit where already developed; strikes and dips of stratified formations, of veins, fractures, and cross-fractures; boundaries of different formations, and boundaries of altered portions of any particular formation. Other points may occur to the worker in special cases. With these things shown it is easier to reach a conclusion as to the nature of the orebody and conditions governing its formation.

Among the things emphasized by such mapping are, for example, the association, perhaps, of ore with some particular type of rock; the importance of cross-fractures; or the occurrence, extent, and nature of faulting. But the important point is that there is a graphic representation of conditions which appeal strongly to the mind; with this at hand it ought to be much easier to direct exploration and development along the most productive lines.

The Work not Difficult

It does not require a man of specialized geological training to make a map of this kind; it can be done by anyone who can distinguish rock types and use a compass, or by an engineer who has had the average college mining course. The time required for such work is comparatively little in return for the advantage to be derived from it and once the workings have been mapped the question of keeping up to date is negligible.

Of course, there are problems which must be referred to men who have made a careful study of such things, problems which can only be solved after close investigation and, perhaps, as a result of previous experience. But the work of such an expert would be greatly facilitated if he had at hand maps on which he could see at a glance the general conditions which will confront him underground. It would also be of great assistance if a series of rock specimens, with their locations, were at his disposal. Possibly some highly paid "expert" would rather go through the routine work of mapping and collecting specimens; possibly the company would like to pay such a man to do that kind of work. I think, however, that the answer is negative in both cases.

Records of Drill Holes

While speaking of maps and records which would simplify and expedite the work of geological examination, there comes up the point of records of drill holes. In the earlier days on the Michigan iron ranges, thousands of feet of drilling were done and the only record is an occasional entry, in a dilapidated note book, such as, "Ore from 800 to 820 ft." The core was thrown away. Since the iron-bearing series is now more fully worked out geologically, this is no longer the case; the geologist can see any given hole as well as if he had picked out and examined the core on the spot. Samples are kept, labeled with their hole number and depth, and the core trays, together with a record of ore analyses, give the complete history of the hole. In general, the importance of such records in bedded formations is well understood.

However, holes are often driven from underground workings in prospecting vein formations. They are, of course, mostly horizontal and not of unusual length. A great deal of crosscutting is saved by this method. If a parallel stringer of vein material is encountered, a note is made of it; aside from which it is unusual to keep any record. The geologist anxious to know something of the country rock in its relation to the deposit, has a pile of unclassified core to work on, and the value of that is very little. With the ordinary machine used for such drilling the runner has to pull his rods and empty the core barrel for every 10 ft. advance, often more frequently. Hence it would not be difficult for him to furnish a piece of core for every five feet of the hole, nor would it take long to paste on a label with the number of the hole and the distance of the specimen from the working face. Someone at the office could examine this core, or if not that, simply stow it in a suitable tray.

To find maps, collections of rock specimens and samples of core, all in proper condition and available for immediate use, would fill the heart of the examining geologist with joy; but I suppose he must have *some* work to do, so why not let him do it all, and in the meantime use the haphazard system—follow the line of least resistance? J. H. Farrel.

Camp Bird, Colo., July 28, 1908.

The Proposed New Mining Law in Mexico

Owing to absence I have not followed the discussion in the Journal concerning the proposed legislation in Mexico dealing with the ownership of mining property by foreigners. I note, however, the editorial and the remarks of the correspondent from Mexico City in the issue of Aug. 1, and I believe legitimate mining companies need fear no great difficulty in carrying on their work, or acquiring and retaining title under any law which may be passed. I am told that the irresponsible have been in the habit of conducting operations in Mexico without complying with any of the laws of the country, not even registering the company, as we may call it, or having any legal representative. Many of our own States require foreign corporations doing business within the State to file copies of papers relating to their incorporation, and to pay an annual tax.

I believe the idea of the Mexican government may be made clearer by outlining

an experience which occurred last fall before the proposed legislation was talked of. At that time certain men wished to acquire title to mining property within the Twenty-League zone, adjacent to the boundary of the United States, in which the ownership of property by foreigners has always been prohibited. Advice as to the method of procedure was asked of the State Department and referred to the American minister at the Mexican capital. In replying our minister stated, in effect, that permission to hold property was commonly granted on application, but if not the matter could be arranged by the formation of a company in which the title would be vested under the laws of Mexico. He further added that it should be understood that the Mexican government does not look with disfavor upon this scheme as a subterfuge for acquiring title, but rather desires to encourage foreign capital in obtaining title in this way.

On looking into this matter further I found that companies so organized possessed rights and legal standing far superior to those of a company not incorporated under the laws of the country. In fact I question if there may not be many companies operating in Mexico today which hold their titles, not having complied with the laws of Mexico, but simply through the sufferance of the officials. And I believe that any law which receives the sanction of the Mexican government will prove to be a safeguard to the interests of foreign capital.

GEO. A. PACKARD.

Butte, Mont., Aug. 10, 1908.

Analysis of Roman Bronze

During a visit to the Washoe smelter at Anaconda, Mont., E. P. Mathewson, the general manager of the plant, showed me a piece of bronze which had been broken from the shaft of an old water wheel in the lower Roman workings of the north lode of the Rio Tinto mine, Solomon mountain.

The water wheel was probably built about the time of Christ. Coins found nearby were of the age of Vespasian, 70 to 81 A.D. The broken shaft was recovered in May, 1903. The analysis, which follows, was made on April 29, 1904, by Henry N. Thomson, the metallurgist of the Washoe plant: Arsenic, 0.5 per cent.; antimony, trace; copper, 77.3; iron, 1.1; tin, 9.2; lead, 10.5; silver, 10.2 oz. per ton; gold, 0.2 oz. per ton; total, 98.8 per cent.

As there is no record of the occurrence of tin in the neighborhood of Rio Tinto, it was probably brought from Lusitania (Portugal) or the Cassiterides (Cornwall), where the Phoenicians and Romans worked mines before the Christian era.

GEO. W. MAYNARD,
Mining and Metallurgical Engineer.

New York, Aug. 10, 1908.

Operating Costs, Homestake Slime Plant

The accompanying tabulated and analyzed statement of operating costs of the Homestake slime plant for March, 1908, shows the results of a typical month.

We are now adding two more presses and will begin grading shortly for several more in order to take care of the additional proportion of fines which will result from the operation of the fine-grinding plant now being installed.

C. W. MERRILL.

San Francisco, Cal., Aug. 4, 1908.

OPERATING COSTS, HOMESTAKE SLIME PLANT, MARCH, 1908.

	COST PER TON.					
	Labor.	Electric Power and Lighting	Chemicals.		Other Supplies.	Total.
				Cost.		
Thickening	$0.00370				$0.00006	$0.00376
Transportation					0.00030	0.00030
Neutralization	0.00625	$0.00116	Lime, 4.476 lb	$0.02236	0.00006	0.02985
Filling and discharging, Merrill sluicing presses	0.01040	0.00347			0.00239	0.01626
Dissolving and washing	0.02468	0.01502	Cyanide, 0.31 lb. HCL	0.06200 0.02324	0.00014 0.01 (cloths) 0.00026	0.13508
Precipitation, Merrill method	0.00281		Zinc, 0.127 lb.	0.00762	0.00057 (cloths)	0.01126
Heating	0.00218				0.00537	0.00755
Assay office	0.00348				0.00518	0.00866
Superintendence	0.00911				0.00043	0.00954
Miscellaneous	0.01272				0.00117	0.01389
Fire protection					0.00054	0.00054
Refining, bullion expressage and mint charges					0.00864	0.00864
Total	0.07533	0.01965		0.11524	0.03511	0.24533

GENERAL NOTES:

Hydrochloric acid	@	$4.30 per carboy, 10 carboys per press.
Cyanide	@	0.20 " lb.
Lime	@	0.005 " "
Zinc	@	0.06 " "
Labor	@	3.00 + per 8-hour shift.
Power	@	7.50 per H.P. per month.

One suit of filter cloths lasts one year. For 24 presses cloth consumption is 2 suits per month or $0.01 per ton of slime treated.

Total tons treated, 49,946.

Effect of Discharge Level and Water Supply on Stamp Capacity

A paper by Harry T. Pitt (*Journ.* Chem. Met. and Min. Soc., of South Africa, June, 1908, p. 373) gives the results of a series of experiments to determine the influence of the hight of the chuck block and the manner of supplying water to the mortar upon the crushing capacity of the battery. The tests were made at the Rose Deep mill, Transvaal, and the results led to the recommendation of the shallow-front mortar box and the introduction of water through pipes beside and below the feed chute so as to strike the back plate vertically, falling upon the dies in a fan-shaped stream with insufficient force to drive the uncrushed rock against the screen. The advantage of the shallow mortar box is that the discharge may be kept level with the top of the dies, by changing the chuck block as the dies wear down, thus avoiding the necessity of introducing false bottoms.

Six tests were, under varying working conditions, as follows:

(1) Weight of stamp, 1150 lb.; hight of drop, 7 in.; number of drops per minute, 105; size of screen, 500 light mesh; screen area, 520 sq.in.; water supply let into top of mortar box; discharge level with face of dies, the level being maintained by means of false bottoms under the dies and by lowering the chuck block; crushed per stamp per 24 hours 6.153 tons coarse rock and 6.253 screened rock, 1½-in. mesh.

(2) Conditions the same as in (1) except that the discharge level was 1 in. above the face of the dies; crushed per stamp per 24 hours 5.723 tons coarse rock and 5.797 tons 1½-in rock.

(3) Conditions the same except that the water was admitted through four 1½-in. holes level with the ore-feed chute at the back of the mortar box; dies 1 in. below the discharge; crushed per stamp per 24 hours 5.740 tons of coarse rock and 8.878 tons of fines.

(4) Conditions the same as in (3) except that the dies were level with the discharge; crushed per stamp per 24 hours 5.941 tons of coarse rock and 6.034 tons of 1½-in. material.

(5) Conditions the same as in (4) except that the screen was inclined giving 173 sq.in. more area; crushed per stamp per 24 hours, 5.771 tons of the coarse and 6.390 tons of the 1½-in. rock.

(6) Conditions the same as in (1) except that water was admitted through five 1¼-in. holes in the back of the mortar box level with the top of the dies and the discharge lip; crushed per stamp per 24 hours 6.630 tons of coarse and 6.627 tons of 1½-in. material.

Sloss-Sheffield Steel and Iron Company

This company owns extensive tracts of coal and iron-ore lands in Alabama, on which it operates a number of mines. It also owns coke ovens and blast furnaces and is a large producer of pig iron. The report for the year ended Nov. 30, 1907, recently issued, shows capital as follows: Common stock, $10,000,000; preferred stock, $6,700,000; mortgage bonds, $4,000,000. The net surplus over current liabilities is $1,892,449, constituting the working capital.

The earnings and expenses for two years past are reported as follows:

	1906.	1907.	Changes.
Gross earnings....	$6,290,014	$6,751,303	I. $364,289
Expenses.....	4,938,268	4,831,457	D. 106,811
Net earnings....	$1,351,746	$1,822,846	I. $471,100
Depreciation.....	$ 140,901	$ 133,183	D. $ 7,718
Bond interest. ...	210,000	210,000	.....
Total charges...	$ 350,901	$ 343,183	D. $ 7,718
Surplus	$1,000,845	$1,479,663	I. $478,818

Appropriations in 1907 were $969,000 for dividends—7 per cent. on preferred and 5 per cent. on common stock—leaving a surplus of $510,663. Adding the balance of $2,650,917 from previous year made a total of $3,161,580. The expenses include charges for depreciation of coal and iron-ore lands; charges of 35c. per ton on coke, and 25c. per ton on pig iron, to cover repairs and renewals. In addition to the amount charged in expenses, the sum of $660,000 was expended in rebuilding blast furnaces, in new machinery and in improvements and machinery at coal mines and iron mines. Several new coal mines were opened, and new tipples and washers put in. New air compressors at the Sloss iron mines were put in; new washers and other machinery at the Russellville mines.

Business was somewhat restricted in the early part of the year by car shortage; and in October and November by the break in the iron markets.

As this company now owns probably the largest area of unmined iron ore outside of the holdings of the United States Steel Corporation, the following statements from the report are of much interest: "Your company owns 65,000 acres of coal lands and 51,125 acres of iron-ore lands. A pretty fair estimate can be formed as to the coal, as the general thickness of the several seams and the territory covered are pretty accurately known. There is on file in the company's office, an estimate made by one who was unusually familiar with the coalfields of Alabama, in which your coal lands are divided into various groups according to the railroads they may be tributary to, and the coal-bearing acreage in each is carefully computed, and an estimate given of the amount of coal in each seam under it. The statement gives the aggregate amount of coal in the several divisions and seams as 1,435,090,348 tons.

"It is more difficult to make an approximate estimate of the iron ore, as so small a proportion of the 51,000 acres has, as yet, or will for a long time, be developed. In the hard-ore field where the veins are regular about 2060 acres have been developed, and in the brown-ore fields about 1924 acres have been thoroughly tested by numerous test-pits, etc. The ore in the developed hard-ore fields, may be safely, we think, estimated at 72,600,000 tons, and in the 1924 acres of brown-ore land at 26,000,000 tons. Deducting the foregoing hard-ore acreage, there is left on which to estimate 24,695 acres of hard ore. Some of this hard-ore land, it is known, carries a thick vein of ore, while on some of it the vein is thinner, running from 4 to 6 ft. Taking into consideration that not all the acreage is ore bearing, we think it conservative to estimate that the vein on the entire undeveloped acreage will average 5 ft., which should yield 17,000 tons per acre, or a total on the undeveloped hard-ore lands of 419,800,000 tons.

"In the Russellville tract you have 18,600 acres of brown-ore land. The Southern Railway Company having bought the Northern Alabama Railroad, and desiring to know what business there was tributary to the road, employed Joseph Squires, a competent and trustworthy mining engineer, in 1901, to make a report on the Russellville orefield. A copy of this report is on file in the office. The report deals with this orefield at considerable length and sums up the conclusion as follows:

"'In my estimate of the quantity of brown ore on the above 18,400 acres, while there are some acres on said tract that have yielded 25,000 tons to the acre, still, after going over the territory, I have formed the opinion that the whole 18,400 acres will yield an average of 6000 tons of 2240 lb. to the acre, making an aggregate of the whole amount of 110,400,000 tons.'

"Practically all of the 18,400 acres is now owned by your company. Besides the foregoing brown-ore lands located in Franklin county, your company owns 2700 in Tuscaloosa and Bibb counties, 2930 acres in Colbert county, and 2400 acres in Jefferson county, and one-half interest in the Champion mine, owned jointly with the Tennessee company, and estimated to contain 650,000 tons of ore.

"Taking Mr. Squires' report as a basis, and making due allowance for any overestimate, and after deducting 25,000,000 tons from our total estimate, and not including any interest in the Champion mine, we feel that it is conservative to estimate the brown ore owned by your company at 133,500,000 tons. We would, therefore, seem justified in stating that you own: Hard ore, developed, 72,600,000 and undeveloped, 419,800,000; brown ore, developed, 26,000,000 and undeveloped, 107,500,000 tons; making a total of 98,600,000 tons of developed and 527,300,000 tons of undeveloped ore; or a total probable reserve of 625,900,000 tons of iron ore."

Iron Production in Canada

Pig-iron production in Canada for the first half of 1908, as reported by the American Iron and Steel Association, was 307,062 long tons; being 36,962 tons more than in the first half of 1907, but 3984 tons less than in the second half. The production in detail was, compared with the first half of 1907:

	1907.	1908.	Changes.
Bessemer	73,023	60,225	D. 12,798
Basic.....	161,403	195,209	I. 33,806
Foundry, forge, etc..	35,674	51,628	I. 15,954
Total.....	270,100	307,062	I. 36,962

Of the iron reported this year, 301,673 tons were made with coke or bituminous coal, 4798 tons with charcoal, and 591 tons in the electric furnace. In the first half of 1908 and in the second half of 1907 small quantities of ferrosilicon were made by electricity. This production is included in the total figures given above.

Furnaces in Blast—On June 30, 1908, Canada had 16 completed blast furnaces, of which seven were in blast and nine were idle. Of this total 13 were equipped to use coke and three to use charcoal. In addition three coke furnaces were partly erected on the same date, work on which was indefinitely suspended some time ago.

During the first half of 1908 the total number of furnaces in Canada actually in blast for the whole or a part of the period was 14, of which 11 used coke and three used charcoal.

New Mineral Products in California

SPECIAL CORRESPONDENCE

In Riverside county, in California, not far from Hemet, are deposits of both magnesite and manganese, which are claimed to exist in large quantities. A new company has begun work on the magnesite mine, and is constructing roads, buildings, etc. The manganese mines have never been worked, though recently the owners tried to get a satisfactory freight rate to Pittsburg by rail. This they were unable to do, except for the higher grade of ores. Much of the ore is of such low grade that it will not bear shipment. The magnesite mine has not yet become productive.

Citizens of Santa Barbara are organizing a company to develop a deposit of lithographic stone at Pine Mountain in that county, which they declare is of excellent quality. Reports have been favorable, but tests have yet to be made in New York.

T. B. Ferris, of Kern county, has found a large deposit of yellow ocher at his Golden mine, in Amalie district.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. B. Tyrrell, mining engineer, of Toronto, has gone on a trip to Port Arthur, Ont., and Edmonton, Alberta.

J. C. Gwillim, of the School of Mines, Kingston, Ont., has been visiting Whitehorse copper camp, in the Yukon.

George Alexander, manager of the Kootenay Ore Company, has returned to Kaslo, B. C., from a visit to Europe.

W. H. Jeffery, formerly with La Rose Company, is now superintendent of the Chambers-Ferland mine, Cobalt, Ontario.

Lawrence P. Adams, manager of the Guanajuato Amalgamated Mines Company, has returned to the mine from New York.

August Raht, of New York, has been visiting mines and smelters in the Boundary and Kootenay districts of British Columbia.

J. L. Parker is superintending some development work for the Tyee Copper Company at Sidney inlet, west coast of Vancouver Island.

Arthur W. Jenks, of Seattle, Wash., has gone to Alaska on a professional engagement. He will return to Seattle about the middle of September.

Geo. M. White, of White & Newcomb, Mexico City, has gone to Temascaltepec to begin construction on the new mill of the Seguranza company.

Jules Labarthe, manager of the Consolidated Mining and Smelting Company's works at Trail, B. C., has been spending a month at Salt Lake City, Utah.

J. W. Bryant, mine superintendent for the Tyee Copper Company, has returned to Victoria, B. C., from an examination of copper claims in Whitehorse camp, in the Yukon.

Walter S. Keith, late superintendent of the Oregon Smelting and Refining Company, Sumpter, Oregon, has opened offices as consulting metallurgist in Seattle, Washington.

Godfrey D. Doveton is in Mexico City. He is designing a lixiviation and copper-leaching works for a Guerrero mine, with which he is connected as consulting metallurgist.

E. J. Babcock, dean of the School of Mines of the State University, Grand Forks, N. D., with a party of students, has been looking through mines and smelters in the Boundary district of British Columbia.

A. B. Critchton has been appointed consulting engineer for the Winifrede and Belmont coal companies, Kanawha district, West Virginia, and is at present spending several weeks looking after improvements in those mines.

Chas. Biesel, superintendent of the Consolidated Mining and Smelting Company's Snowshoe mine, at Phœnix, B. C., has returned to the mine from Trail, to resume shipment of ore after seven or eight months' suspension there.

H. Stuart Martin, late general manager of the Dowlais and Abercynm collieries in South Wales, has been appointed consulting engineer to H. Eckstein & Co., of Johannesburg, who control large mining interests in the Transvaal.

Hon. William Templeman, Canadian minister of mines, accompanied by Dr. R. W. Brock, acting director of the Geological Survey, has gone to British Columbia, to investigate mining conditions in the Kootenay and Crow's Nest districts.

William C. Wiper, of Malta, has been appointed coal-mine inspector for the Fourth district of Ohio—Perry, Muskingum and Morgan counties—to succeed James Pritchard, who resigned to become superintendent of mines for the Sunday Creek Coal Company.

Alexander Colledge, mining engineer of Singapore, Straits Settlements, is expected in New York in September. Mr. Colledge represents several large American makers of mining machinery in the Far East, and intends to visit the chief mining centers in this country to investigate recent methods of ore treatment.

Obituary

George Beckman, manager of the Union Coal Company, died in Pittsburg, Penn., Aug. 11, aged 35 years. He had lived in Pittsburg all his life, and had been a coal operator for a number of years.

I. K. Pierson, a civil engineer of Cleveland, O., was killed by falling from his horse, near Puerto Cortez, Honduras, July 24. He was engaged in the improvements planned by the Caribbean Development Company, of New York.

Capt. M. J. Urquhart died at Steubenville, O., in July, 1908, at the age of 69 years. Captain Urquhart was connected, for many years, with the old Jefferson Iron Works at Steubenville, which are now owned by the La Belle Iron Works. He was also president and general manager of the Junction Iron and Steel Company at Mingo Junction, Ohio.

Ernest Thies, manager of the Haile Gold Mines, in South Carolina, was so badly injured by the explosion of a boiler at the mine, Aug. 10, that he died the following day at Charlotte, N. C., to which place he was taken atfer the accident. He was a son of Captain A. Thies, so widely known as an expert in chlorination, who made the Haile the most successful mine in the South. Ernest Thies spent most of his active life at the Haile, for some years as assistant, and after the retirement of his father some years ago, he was appointed manager, and continued the work with success. He had also done some work as mining and consulting engineer in the Dahlonega goldfield in Georgia.

Societies and Technical Schools

American Electrochemical Society—The fall meeting of this society will be held in New York City, Oct. 30 and 31. Dr. J. W. Richards, Bethlehem, Penn., is the secretary of the society.

Michigan College of Mines—The yearbook of the Michigan College of Mines, Houghton, Mich., for 1908, shows full courses in mining and metallurgy. It is expected, early in the year 1908-9 to move the library into the new library and mineralogical building now in course of erection. Accompanying the year-book is a series of views of the buildings and field work.

Wisconsin State Mining Trade School—This school, founded at Platteville last year, will reopen Aug. 31. Prof. H. C. George, formerly instructor in mining engineering at the Western University of Pennsylvania, succeeds R. B. Brinsmade as director. Courses have been revised and laboratory equipment completed. The purpose of this school is not to graduate mining engineers, but rather mine-foremen and mill-men and to train young men to fill subordinate positions in mining. A two-years' course is offered. A common school diploma or its equivalent upon entrance examination are the requirements for the regular course.

New Mexico School of Mines—The catalog of this school at Socorro for 1908 shows courses in mine engineering, metallurgy, mining geology and civil engineering. This school, we believe, is the only one which owns and operates a mine. It has become the owner of the Torrance gold and silver mine at the base of Socorro mountain, only two miles from the campus. This mine affords excellent opportunities for the practice of mine-surveying and for a study of all the various features of practical mining. Here are to be studied a double-compartment incline shaft, a fine example of mine-timbering, various levels, crosscuts, winzes, shafts, stopes, orebodies with associated geological structures and other features of interest to the student. The school has also come into possession of the private library of the late Major John W. Powell, for many years director of the United States Geological Survey. The collection embraces several thousand titles, chiefly works on mining, geology and philosophy, many of which are rare, and all of practical value. Especially well represented is the literature relating to the Rocky Mountain region and the Southwest. It was in these fields that Major Powell did most of his work.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Salt Lake City, Denver, Goldfield, Toronto and Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

Aug. 12—The Selby Smelting and Refining Company has filed in the Superior Court at Fairfield, Solano county, a motion for a rehearing of the action through which an injunction was secured by the county prohibiting the company from operating its smelter on account of the fumes carried to Benicia by the trade winds. More than 100 affidavits were filed in support of the motion and an appeal will follow the expected denial. The company contends that the enforcement of the injunction now is unfair because the Cottrell electrical system for controlling the poisonous vapors is on the eve of completion. Further test runs were prohibited by the injunction being enforced completely at request of the Benicia citizens. Ten days' time has been given the company to file additional affidavits in the request for the new trial.

The large gold dredge of the Shasta Dredging Company, at Horsetown, Shasta county, was entirely destroyed by fire last week, entailing a loss of about $125,000. The cause was in connection with the electric power appliances on the boat. This dredge had only been in operation for two months, and was the second built by the company. The first one, at the same place, was also burned.

It is supposed that Eastern capital will shortly lend its aid to enlarge the smelting plant at Needles, San Bernardino county on the Colorado river, on the line of the Santa Fe railway. The present smelter is the only one in southern California and the only one accessible to southern Nevada nearer than San Francisco or Salt Lake. Three years ago Manager Godshall, aided by Pennsylvania capital, bought the old plant of the Fletcher Smelting Company, enlarged it and rebuilt it to handle both lead and copper ores, and lately a new furnace has been added to meet the growing business from southern California, Nevada and northern Arizona

There are now no dredges operating in Trinity county, but a Keystone drilling apparatus has been set at work prospecting the gravel beds on the Junkans ranch near Weaverville, and if the tests are satisfactory, a dredge will be built to work the ground. A Florence drilling apparatus has also been taken to prospect the ground of D. N. Ulm on Clear Creek in Shasta county. In this connection it may be stated that Thos. Rockhill and R. H. Richardson, of Ely, Nev., C. W. Gaby, of Osceola, and F. B. Weeks, are about to test the placer ground with drills in Snake Valley east of Osceola.

Wallace, Idaho

Aug. 10—As the result of a general appeal to the commissioners of Shoshone county the assessment on the big dividend-paying mines of the district has been lowered about $42,700. The companies affected are the various properties of the Federal Mining and Smelting Company, Hercules, Bunker Hill & Sullivan, Hecla, Gold Hunter and Frisco. The apportionment of the decrease to each company is as follows: Federal Mining and Smelting Company, $13,500; Bunker Hill & Sullivan; $10,000; Hercules, $6000; Frisco, $5000; Hecla, $4200; Gold Hunter, $4000. The total valuation placed by the assessor on these companies together with the Snowstorm, Cœur d'Alene Mining Company, Golden Chest and Success amounts to $1,092,846, apportioned as follows: Hecla, $76,130; Hercules, $113,900; Snowstorm, $119,914; Bunker Hill & Sullivan, $241,277; Cœur d'Alene Mining Company, $27,684; Federal Mining and Smelting Company, $466,566; Frisco, $27,250; Golden Chest, $9775; Success, $10,350.

Goldfield, Nevada

Aug. 11—After having accomplished an amicable settlement of the litigation between the Consolidated and the Jumbo Extension, ex-Gov. C. S. Thomas, of Colorado, chief counsel for the Consolidated, has made formal application to the Federal court for dismissal of the apex suit brought on account of the Wedge claim. A deed to the claim in question has been conveyed to the Consolidated and it has been filed for record, as has also the counter agreement regarding the ore to be extracted from the Vinegarone and Polaverde properties.

The new process of treating concentrates being worked out by the Consolidated has succeeded so far beyond the company's best hopes that a plant is being designed as auxiliary to the new 600-ton mill to treat the concentrates from the latter. An extraction of 95 per cent. is practically assured.

Salt Lake City

July 31—The Utah Copper Company will disburse its initial quarterly dividend September 30, of 50c. per share. Inasmuch as there are 75,000 shares of convertible stock, the aggregate sum to be disbursed is as yet indefinite. However, there are 660,000 issued shares outstanding; but if all of the convertible stock is issued there will be 735,000 shares entitled to the dividend, making a total of $367,500. The company is arranging to increase the ore-treatment capacity of its Garfield concentrator to 10,000 tons per day, the present facilities providing for 6000 tons.

The Boston Consolidated Mining Company is going to increase the production of its Bingham mine and by September 1 four more sections of the Garfield concentrator will be in commission, the number now in use being four. Each section is designed to treat 200 tons of ore per day. The management recently succeeded in obtaining a modified smelter contract which is much more favorable.

Although no official statement has been released, it is reasonably certain that the Ohio Copper Company, of Bingham, will resume construction on its concentrating mill at Lark in the Bingham district. It comes from a reliable source that the bonds authorized by the directors have been underwritten, which assures ample funds to round out the enterprise. Ohio Copper is one of the really big low-grade copper mines of Utah. The initial capacity of the mill is for 2000 tons of ore per day.

Butte

August 13—The Butte-Balaklava Copper Company has instituted action against the Butte, Anaconda & Pacific Railway Company for the purpose of quieting title to the Balaklava lode claim. The complaint states that the railway company asserts an interest to a portion of the claim adverse to the mining company.

F. B. Lindman, secretary of the Montana Mine Owners Association, announces that the Panhandle smelter at Sand Point, Idaho, is ready for treatment of ore. The decision of the Montana railway commission with reference to railway rates on ore shipments is expected within a short time, and when it is announced, the mine owners hope that the rates will be sufficiently low to enable the small mines in the State to resume operations. At the hearing before the commission, the railroads raised the point that, since shipments between Montana and Idaho would be interstate commerce, the State commission would be without jurisdiction to declare a rate affecting shipments from the mines of association members in Montana to the association smelter in Idaho. The success of the smelter will depend in a large measure upon the decision of the commission.

Allen Giberson and others have begun an adverse suit against the Tuolumne Mining Company for the purpose of de-

termining the right to patent of the Smoky Moke lode claim. The plaintiffs state that they located the claim in 1904 under the name of the Marrimac and that in May, 1908, the defendant company applied to the Government land office for patent to the same ground under the name of the Smoky Moke claim.

Peter Lackner, formerly managing director of the Butte & Buxton Copper Company, has resigned, and Charles Fasel has been appointed to succeed him.

Denver

Aug. 14—On Aug. 12, passenger-train service on the Moffat road was inaugurated to Toponas, 176 miles from Denver. The rails have been laid to Yampa, a further distance of nine miles.

The gold strike in the vicinity of New Castle is still attracting attention, and all the desirable ground has been taken up. Some assays taken by miners from Leadville ran 2 oz. gold per ton, it is claimed.

Mining in Leadville is slowly reviving from the depression of last fall, and with the increasing price of lead and zinc preparations are under way to resume mining on the usual Leadville scale. Developments in the Yak tunnel have resulted in the opening of considerable stoping ground. A fair tonnage is now being produced, and the new portion of the Rowe mill is kept in full operation. In the process used there the mixed pyrite-blende ores are treated by low-tension magnetic separators after a preliminary roast in White-Howell furnaces, and apparently with success. The larger and older portion of the mill was designed to treat the raw ores by high-tension International separators, but this portion of the plant has not been in operation for some time. Possibly the diminished output of the camp has something to do with this state of affairs, yet some of our leading metallurgists have long held that the magnetic roast was essential to a close separation of the pyrite from the Leadville blende. The Iron Silver Mining Company is developing the Tucson claim, on top of Iron hill. The shaft has been sunk to the Cambrian quartzite, and larger bodies of zinc ore found in the white limestone. Should this ore make below all of the big ore shoots of the old Iron mine, as some experts predict, it would add a new lease of life to this once famous producer and oldest mine in Leadville.

It is reported that a contract has been let to an Eastern engineering concern for the erection of a steel building at Ironton, for the matte smelter which is being built for the reduction of the copper ores of the Mono-Baltic property, of Red Mountain, in the San Juan region.

Shipments of ore and concentrates from Idaho Springs during July show an increase of 20 per cent. over the corresponding month of last year. One of the most important mining transactions of the week in Gilpin county was the granting of a lease by the Waldorf Consolidated company, of a large block of its ground to a Kansas City syndicate. The lease is for an indeterminate period, and calls for work requiring $30,000 or $40,000 expenditure.

Indianapolis

Aug. 17—Just as the mining situation had changed to that of activity the idle mines resuming operation and work plenty for all the miners, many of whom had been idle all summer, a strike has been declared in District 11, affecting nearly 10,000 men in the Indiana bituminous field. The calling out of the men by President Von Horn of the mine workers is the outcome of the action of the Indiana Operators' Association in declaring relations with the miners severed. This action is due to what the operators declare a violation of the agreement on the part of the miners. This agreement provides that no miners shall stop work as long as an effort is being made to settle an existing difference. A driver was discharged in the Rood mine of the Hudson Coal and Mining Company near the line of Vigo and Sullivan counties and in the absence from the State of President Coulson of the Operators' Association, Vice-President Curry of the miners' association called the men out at the Rood mine. The immediate cause of the present trouble at the Rood mine is trivial, but the real dispute is regarding the clause in the wage contract that provides that grievances can be appealed to the secretary of the Operators' Association and the president of the Mine Workers' Association of the district, and stipulates that these two officials shall be a court of last resort; furthermore that they must reach an agreement.

The grievance at the Rood mine was taken up by these officials, but before an agreement was reached and while Secretary Penna of the Operators' Association was absent from the State, the vice-president, acting in the absence of the president, ordered the men to quit work. President Lewis of the International Association advised the vice-president to put the men back to work holding that the step was a violation of the agreement, but his advice was ignored.

The operators regard the action of the miners as serious, and have declared that until the mine in question resumes work, the relationship between the association and the mine workers of District No. 11 are severed. Further, that the check-off for all purposes would be discontinued until further notice.

This last decision of the operators to stop taking out of the pay of the men the amount of their dues to the labor organization is conceded to be a vital blow, as ex-President John Mitchel has always frankly said that if these dues were not collected in this manner by the operators on pay-day the life of the organization would be menaced.

The strike in the bituminous field does not affect the Block Coal district, the men remaining at work,

It is conceded that a strike or suspension of work in the Indiana mines at this time works hardship on both miners and operators. The mining situation had just begun to assume normal conditions. Many unemployed men had begun work, and others were to begin Aug. 16. The idle mines have been cleaned out at great expense to operators and a delay in starting fall business will prove disastrous. Just at present the operators want coal, and in this way the miners seem to have the best of the situation. The operators, however, state that the fight is to the finish; that the check-off system in the entire State will be abandoned and that the officials of the mine works will hereafter have to collect dues from their members themselves if any are collected. They are determined that the provisions of the agreement shall not be violated at will by the miners.

Mexico City

Aug. 9—In connection with the efforts of the Chamber of Mines to prevent the passage of the new mining law, the recent circular issued by the president of this body is of interest. The circular is for the public generally and miners in particular and asks for data. It reads in part: "We would be greatly obliged by your forwarding to us, either in the original or copied, the letters or paragraphs contained therein which are pertinent to this subject, and which you may have received from prominent persons in this country or abroad, and at the same time inform us, if possible, what negotiations for the purchase of mines or for the organization of foreign companies for that purpose have been suspended through fear that such a bill will pass."

The article to which objection is made is as follows: "Foreign companies shall hereafter be incompetent to locate or acquire, under any title whatever, mining properties or real rights over the same within the territory of the Mexican republic."

The mining outlook is brighter in México than it has been for a long time. Construction work which had been delayed or entirely stopped has started again, and one hears of contracts being let on all sides. The new water-power plant near Temascaltepec has stimulated building in that vicinity. It is reported that the "La Quimica" will build a cyanide addition to the concentrating mill. The "Seguranza" has practically let the contract for a 20-stamp, fine-grinding mill and cyanide plant. This mill will be equipped with tube mills, Brown air-agitation tanks and vacuum filters.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

General Mining News

The total value of the gold bullion received at the United States Assay Office, Seattle, Wash., during the year ended June 30 last was as follows: From Nome, $3,805,145; Tanana, $8,450,033; other Alaska, $550,908; total from Alaska, $12,806,086. Receipts from Washington, Oregon, etc., were $71,536. From British Columbia, $1,515,838; from Yukon Territory, $1,552,733. This makes $12,877,622 from the United States and $3,068,571 from Canada; $15,946,193 in all.

Arizona

COCHISE COUNTY

Calumet & Arizona—The July output of blister copper from the ores of the Calumet & Arizona and Superior & Pittsburg mines was under 4,000,000 lb. An average of 1400 tons of ore per day was smelted, 100 tons less than the usual tonnage. Several repairs and changing of air pipes at the smelter necessitated the partial shutting down for a short time during the month.

Superior & Pittsburg—On the 1300-ft. level junction a large body of sulphide ore carrying 12 per cent. copper has been opened up. This body of ore is immediately under a similar body on the 1200-ft. level. Preparations are being made to start stoping on the small bodies of high-grade oxide ore lying above the 90-ft. level of the No. 3 shaft and outcropping on the surface near the shaft. Since the No. 3 shaft has no railroad connections this ore will be lowered in cages to the 1000-ft. level and hauled by mules to the Cole shaft. A crosscut in the Supplement claim has developed 50 ft. of 5-per cent. oxide ore. This crosscut is about 150 ft. from the side line of the Buckeye claim of the Calumet & Arizona. About 15 ft. of 12-per cent. oxide ore has been cut in a raise in the northeast corner of the Sunnyside claim on the 1000-ft. level. A crosscut on the 1100-ft. level has passed through 50 ft. of oxide ore carrying 10 per cent. copper, but high in alumina.

Shattuck-Arizona—Nothing definite has been given out about the erection of the new smelting plant at Douglas, but the mines are kept in readiness for shipping ore. The sulphide stope on the 800-ft. level where a big body was taken out before shipments were stopped has been kept open and is in shape to ship 250 tons daily carrying 5 per cent. copper. In addition the oxide stopes can furnish 250 tons of high-grade ore. The development work consists of one drift on the 600-ft. level and three drifts on the 700-ft. level. The southwest drift on the 600-ft. level has passed through 30 ft. of good oxide ore. Crosscuts east and west on the 700-ft. level have recently cut bodies of low-grade sulphide ore.

Warren Realty and Development Company—The three-compartment shaft has reached a depth of 700 ft. A tongue of porphyry 3 ft. thick was recently cut. The porphyry was iron stained and carried small quantities of copper. For most of its depth the shaft has been sunk in hard gray limestone.

Butte & Arizona—Development work has been resumed with a force of 30 men on this property, which was shut down the latter part of June.

GRAHAM COUNTY

Arizona Copper Company, Ltd.—The production for July was 1320 tons of copper. Operations at the furnaces were interrupted by putting in new flues.

Arkansas

LOGAN COUNTY

Standard Coal Company—This company has been organized to open and operate coal mines. W. H. Foster, Paris, Ark., is president.

California

AMADOR COUNTY

Valparaiso—A small 3-in. seam of "black metal" of very high grade has been found in this mine. It is first roasted and then crushed, at the mine.

CALAVERAS COUNTY

Conradi—At this hydraulic mine, Railroad Flat, a contract has been let to run a 700-ft. open cut, and to cut down the tail-race so they can bottom the channel.

Live Oak No. 2—Louis Thomas of San Francisco has bonded this mine (also known as the Haley) at El Dorado, and men have been set at work.

McCann—At this gravel mine, Chile gulch, F. W. Peck, superintendent, the tunnel is being cleared out and other improvements made.

San Andreas Blue Channel—Hedrick Bros. have installed a new pump at this property and are unwatering the Hedrick and Anderson claims.

FRESNO COUNTY

Eagle Peak—The new mill of this company at Trimmer has been completed and the first clean-up has just been made.

HUMBOLDT COUNTY

Weitchpec—A number of new placer claims have been located at this place and water will be brought in from Hopkins creek.

INYO COUNTY

Tecopa Consolidated—Work has been resumed at this property with 50 miners employed. The lead ore is shipped to smelters at Salt Lake.

KERN COUNTY

La Cross—A gasolene hoisting engine, with compressor and machine drills, has been shipped to this mine at Sunshine.

LASSEN COUNTY

Lassen County Mining and Milling Company—This company has completed the installation of its cyanide plant in conjunction with the new 10-stamp mill.

MARIPOSA COUNTY

Mariposa—Manager F. T. Maguire of the Mariposa Mining and Commercial Company is about installing a 10-stamp mill at this mine, and the main shaft is to be retimbered. Leases in the different levels will then be let.

NEVADA COUNTY

Mayflower—This mine at Canada Hill, Nevada City district, has been bonded to people from Honolulu. It is well equipped with necessary machinery.

Colorado

TELLER COUNTY —CRIPPLE CREEK

Gillett Mill—O. P. Grimes and associates, who lately reconstructed the old Gillett mill, are now engaged in installing concentrating tables and will have the mill in full operation soon. The plant, which has a capacity of 150 tons per day, has been in continual operation for some time treating the old Kimball dump on the property, and a fair extraction is reported. The dumps contain enough material to run the mill for six months.

Longaconing—Lessees on this mine, on the western slope of Beacon hill, have opened up a promising vein.

Mayflower—Lessees in this mine have struck a vein which gives good results in gold. They are now sinking to find whether it continues.

Monmouth Mining and Leasing Com-

pany—This company, capitalized for $500,000, has been formed for the purpose of operating on the Fluorine property on the south stope of Copper mountain. Incorporators are Henry Rassbach, William Galloway and H. L. Bull. The leasing company has opened up a body of milling-grade ore. A mill on the property of 50 tons daily capacity will be used to treat the product. Operations are conducted through the Blanchard tunnel at a distance of 1100 ft. from the portal.

Roanoke—An examination is being made of this mine on Mineral hill, under direction of President W. F. Burns of the Cripple Creek Land and Mining company, owning that claim and the Emma placer adjoining just beyond the corporate limits of the city. The property has been sunk to a depth of 335 ft., and bodies of low-grade ore are exposed in the different levels.

Kansas

ZINC-LEAD DISTRICT

Chicago - Quapaw — This company is erecting a 150-ton mill on the Julia S. Shopp land at Baxter Springs.

Lucille—This company has let a contract to Wiggington & Milton, of Webb City, Mo., for a 250-ton mill on its land near Baxter Springs.

Kentucky

MUHLENBURG COUNTY

Green River Coal and Coke Company—This company has bought a large tract of coal land near Penrod, and is having surveys made preparatory to beginning development. C. H. Shattuck, Parkersburg, W. Va., is president; S. D. Brady is chief engineer.

WHITLEY COUNTY

Superior Coal and Coke Company—This company has been organized to open and operate a coal mine near Halsey, W. C. Tucker, Halsey, Ky., and G. W. Stephens, Chattanooga, Tenn., are incorporators.

Michigan

COPPER

Keweenaw—Daily rock shipments, varying from 250 to 350 tons, are being made to the Phoenix mill. The rock is coming from the stock pile, which at the beginning of mill operations was estimated to contain approximately 75,000 tons; nothing has been shipped direct from the underground openings to the mill. Everything at the mill is working satisfactorily and the new Woodbury jigs will soon replace the present jigs.

Seneca—The new shaft which is being sunk on this property is down more than 40 ft. This shaft is going down in the footwall about 60 ft. behind the lode and with the same dip as the lode. The first level will be established at a depth of 150 ft. and a crosscut driven to cut the lode. The drills, at the present, are being run by steam, but a compressor will soon be installed.

Copper Range—Preparations have been about completed to begin drifting from the 1000-ft. level of the shaft on the Globe tract, which is held under option by the Copper Range company. In cutting a landing at this level some copper-bearing rock was encountered. All work for the present will be centered at this point.

Ojibway—The concrete collar at No. 1 shaft has been completed and the same work was commenced at No. 2 shaft. Sinking is going on in No. 1 shaft at a depth of 300 ft. and in No. 2 at 365 ft. A crosscut will be driven from each shaft at a depth of 500 ft. to cut the lode and drifts extended from the point of intersection.

Atlantic—Sinking is going on at a depth of about 90 ft. below the 16th level at the section 16 shaft, and the formation encountered is more settled and firmer. The south drift from the 12th level is nearing the Baltic line.

Superior—The crosscut from the 10th level of No. 1 shaft has reached the lode which at that point is found to be as well mineralized as at the levels above. The temporary shaft house will soon be ready for erection and while this is being assembled the shaft will be widened from the 2nd to the 4th level to accommodate two skipways.

Minnesota

IRON-VERMILION RANGE

Chandler—The last shipments from this mine were made July 31, taking all that remained of the accumulated stock-pile, which was about 200,000 tons at the opening of the present season. This is probably the last shipment that will be made from this famous mine. It has been known for some time that the end of the mine was approaching, and it is now understood that last winter saw a practical end of hoisting in the shaft. The Chandler mine was the second Minnesota mine to ship ore. The first ore was sent down in 1887 and since that time, exclusive of the ore mined last winter, 9,096,639 tons have been shipped. The deposit was discovered by James Sheridan, is located on land owned by Martin and W. H. Pattison, of Duluth, was opened up by Capt. Joseph Sellwood, the operating lease was acquired by the Minnesota Iron Company and later transferred to the Oliver Iron Mining Company. The ore from the Chandler, like that from the Pioneer which adjoins it, is a hard bessemer ore, always noted for its grade, holding up well over 60 per cent. iron.

Montana

BUTTE DISTRICT

Reins—At a special meeting of the stockholders, held in Butte recently, for the purpose of voting on the issuance of bonds to provide funds for the operation of the property, directors were authorized to issue bonds to the amount of $600,000, the bonds to bear 6 per cent. interest for a period of five years. Operations at the property of the company were suspended last fall owing to financial troubles, but with the issuance of the bonds it is reported that work will be resumed.

Butte & Milwaukee—At the Colonel Sellers claim, the installation of a new first-motion Nordberg hoist has just been completed. Work is now progressing on the installation of electric pumps preparatory to the resumption of operations. When the shaft has been unwatered sinking will be begun. The shaft is now down 800 ft.

Pilot-Butte—A special meeting of the stockholders has been called for Aug. 17, to be held at Milwaukee. The notice states that the purpose of the meeting is to provide means for making a payment on the option now held by the company and for raising additional funds by sale or mortgage of the company property.

LEWIS & CLARK COUNTY

Pittsburg & New York Copper Company—The company has been recently formed for the purpose of working gold properties situated in the Seven Mile mining district, west of Helena. The company holds under lease and bond what is known as the Umatilla group of claims, consisting of eight quartz claims, two timber claims and a millsite. The properties have not been worked for a number of years and have never been explored to a greater depth than 50 feet.

DEER LODGE COUNTY

Butte - Cable Mining Company — The property is situated 16 miles west of Anaconda, in the same district with the Southern Cross, Gold Coin and Cable Consolidated mines. The shaft has been sunk 40 ft. and drifting is being done on the vein. The management states that a recent small shipment of ore showed $50 per ton, principally gold, with some copper and silver.

JEFFERSON COUNTY

President Copper and Gold Mining Company—This company has been recently organized by Butte men for the purpose of exploring a group of gold claims in the Big Foot mining district, about 10 miles southeast of Boulder. The company holds 11 claims, in which two shafts have been sunk, one to the depth of 210 ft. and the other to the depth of 80 feet.

Nevada

CHURCHILL COUNTY—HAZEN

The sampler of the Western Ore Purchasing Company, at Hazen, is handling an average of 300 tons of ore per day

from Goldfield and Rawhide, and from Churchill and Humboldt counties.

CHURCHILL COUNTY—WONDER

Gibraltar Investment Company—This company, owning the June Wonder, Rex and Queen properties, will start work on company account immediately, and will also grant several leases. This company owns between 50 and 60 mining claims.

ESMERALDA COUNTY—GOLDFIELD

Production—The output for the week ending Aug. 11 was smaller than usual, due partly to the shut-down of the Western Ore Purchasing Company for four days to overhaul machinery. The Combination mill treated 665 tons of Consolidated ores and the Kinkead mill treated 60 tons of Combination concentrates. The Nevada Goldfield Reduction Company treated from the Engineers' lease, 278 tons; Combination Fraction, 190 tons; Consolidated Red Top, 178 tons; Frances Mohawk, 47 tons; Commonwealth, 51 tons; Florence Annex, 5 tons; Sandstorm, 17 tons; Mohawk Jumbo, 102 tons; Black Butte, 40 tons; Mohawk Combination, 30 tons; Hayes dump, 65 tons. The Western Ore Purchasing Company handled from the Little Florence dump, 49 tons; Engineers' lease, 84 tons; Johnston & Fox lease, 13 tons; Mushett lease, 271 tons; Mohawk Jumbo, 100 tons. A total of 2001 tons valued at $181,905.

Albermarle—Company work has stopped temporarily. The leasers will continue.

January White Rock—Both sinking and crosscutting, except on the upper level, have been suspended, due to the flow of water on the 370-ft. level.

Consolidated Jumbo—The shaft of this new lease has reached the 160-ft. point, and a crosscut at 150 ft. has been started.

Goldfield Rosebud—The Rosebud is in low-grade vein matter and work is being pushed to pick up the shoot of the Rogers Syndicate.

Engineers' Lease—Shipments from the Engineers' lease are being kept up at the rate of 60 tons per day. The ore is coming from a stope from the 300-ft. level and is maintaining an average value of $200 per ton.

Daisy—The property has laid off 20 men and is now practically idle. No plausible excuse is given for the shut-down.

Lone Star—The Truax lease on the Lone Star has resumed shipments.

Mohawk Jumbo—The company has resumed work on its lease on the Wedge claim, recently released from injunction, and has already made a shipment. Five machine drills are at work in the stopes between the 400- and 500-ft. levels.

Plymouth Mining Company—This company, operating a lease on blocks 6 and 9 of the Combination No. 3 of the Consolidated ground, has resumed operations after a temporary shut-down.

WHITE PINE COUNTY—ELY DISTRICT

Dolly Varden—The management has decided to sink a new three-compartment shaft to the 1000-ft. level. A hoist and air compressor plant, both of large capacity, will be installed.

Star Pointer—This mine is idle at present, but it is rumored that operations will soon be resumed. The mine has a very large and elaborate steel gallows frame and good accommodations for several hundred men.

Copper Flat—About 200 men are employed around the steam shovels and churn drills. One steam shovel is engaged in stripping and the other is furnishing 500 to 700 tons of ore per day.

Giroux Consolidated—At Kimberly the 500-ton concentrator is completed and ready for business while the 250-ton smelter is rapidly reaching completion.

North Carolina

MONTGOMERY COUNTY

Iola Gold Mining Company—Milton L. Jones, of Minersville, N. C., has been appointed permanent receiver.

ROWAN COUNTY

Gold Hill Mining Company—In the Rowan county court last week B. B. Miller, of Salisbury, N. C., was appointed receiver of this company in a suit brought by W. G. Newman, formerly president of the company, who has claims against it for about $300.000. The mine is one of the oldest in North Carolina, and was for many years worked as a gold mine. With depth copper ore was found, and in recent years it has been worked as a copper mine. The present company was organized as a copper company in 1900, with $5,000,000 capital stock. In 1903 Mr. Miller was made receiver, but in 1906 the company's difficulties were arranged and the receivership closed. Mr. Newman retired from the presidency at that time, but claims that he advanced money to settle the debts of the company, which is still unpaid, and that the company has placed a mortgage on the property, without the knowledge of the other creditors.

Oregon

BAKER COUNTY

Morning—This mine, in the Greenhorn district, has been leased to J. Hazelwood, of Sumpter, who has begun work upon it.

Red Boy—Development work is being carried on at this mine with some success. A new pump has been installed to handle the heavy flow of water.

St. Anthony—George H. Phillips is now in charge of this mine. Development work has made such progress that he has leased the Alamo mill for the purpose of treating the ore.

Pennsylvania

BITUMINOUS COAL

Pennsylvania Coal and Coke Company—On the application of the Scranton Trust Company, trustee for the bondholders, Thomas H. Watkins, of Scranton, Penn., was appointed receiver for this company on Aug. 15. The company's entire property is leased to a holding company, the Pennsylvania, Beech Creek & Eastern, which agreed to pay as rental interest on the bonds and a dividend on the stock. The application for the receivership was based on a default in the payment of rental by the holding company. The Pennsylvania Coal and Coke Company owns directly, or through subsidiary companies, about 117,000 acres of coal lands in Cambria, Blair and Indiana counties, on which 33 collieries are in operation, besides 1000 coke ovens. The production of these collieries is over 12,000 tons a day, when demand is good. The company also owns a large number of cars, besides shipping piers and barges at tidewater in New York harbor, and other facilities for marketing coal. By the latest report there were outstanding $3,893,000 common and $3,768,000 preferred stock; also $6,563,000 in consolidated bonds.

South Carolina

LANCASTER COUNTY

Haile Gold Mine—A large boiler at this mine exploded Aug. 10, wrecking the engine-house with two 100-h.p. engines and badly damaging the large stamp mill. The full extent of the damage has not yet been ascertained. Ernest Thies, manager of the mine, was fatally hurt and three others were badly injured. The Haile mine is the only gold mine successfully worked in South Carolina.

Virginia

MONTGOMERY COUNTY

Beacham Coal Company—This company has bought a large tract of coal land on Price mountain, and is preparing to open a coal mine with a capacity of 100 tons daily. William Beacham, Christiansburg, Va., is manager.

Utah

BEAVER COUNTY

A Salt Lake syndicate has recently acquired a large area, about 70 lode mining claims, contiguous to the Horn Silver mine at Frisco, and has organized the King David Mining Company, which will immediately begin development. A shaft is to be sunk 1000 ft. and the promoters hope to encounter a continuation of the vein of the Horn Silver.

JUAB COUNTY

Colorado Mining Company—This company, operating in the Tintic mining dis-

trict, has returned to a dividend basis after a recess of about six months, and pays 12c. a share, or $120,000, Aug. 20. The new compressor plant recently installed, is in commission.

SALT LAKE COUNTY

Ohio Copper Company—This company has resumed work in earnest. While $2,000,000 in bonds were authorized some time ago, it is said only a portion of the allotment will be issued, as the expenditure of one-fourth the amount is practically all that will be required to put the mine in shape to produce ore economically through the Mascotte adit, with which the main workings of the mine will soon be connected, and complete the equipment of the mill at Lark. The initial capacity of the mill will be 2000 tons per day, but it is proposed to increase it to at least 4000 tons per day during 1909.

SUMMIT COUNTY

Silver King Coalition—At the September meeting of directors of this company, operating at Park City, payment of dividends will be resumed. A quarterly distribution of 15c. a share, or $187,500, will occur about Sept. 20 next.

TOOELE COUNTY

Boston & Sunshine—This mine, near Mercur, will soon be producing again. Interests identified largely with the Consolidated Mercur have acquired the property and have begun altering the mill, preparatory to installing equipment similar to that in use at the Mercur. The Sunshine mine contains extensive bodies of low-grade gold ore.

Consolidated Mercur—This is the oldest active gold mine in the State of Utah. It is located in the Camp Floyd district and has been in continuous operation since early in the 90's. While the earnings are not what they used to be, yet the management has overcome serious metallurgical difficulties, and is again making money with the expectation of returning to a dividend basis in the near future—possibly in September. The mine is producing nearly $80,000 monthly in gold bullion. The June production was $78,000. The mill is treating 800 tons of ore per day, with the slimes plant operating on oxidized ore entirely, as that on sulphides was not entirely successful. The company's metallurgists are still experimenting with every hope of overcoming the difficulty.

Sacramento—This company, which paid dividends regularly for several years out of a deposit of cinnabar, has leased its mill dump, and the lessees are getting ready to install equipment to extract the gold.

West Virginia

BOONE COUNTY

Fork Ridge Coal Company—This company has been organized to open a coal mine near Madison. C. A. Croft, Madison, and others are directors.

HARRISON COUNTY

Parkersburg Coal Company—This company has bought 2000 acres of coal land near Clarksburg, and will soon begin work.

PUTNAM COUNTY

Hurricane Branch Coal Company—This company has bought coal lands near Hurricane, and is preparing to work them. E. C. Marshall, Welch, W. Va., is in charge.

Wisconsin

ZINC-LEAD DISTRICT

Board of Trade—This company has just completed a new 100-ton mill on its property at Cuba City and work in the mine will be resumed.

Empire—This mine, under management of the Wisconsin Zinc Company, is turning out between 40 and 50 tons of concentrates per day, milling two shifts. The green concentrates are being roasted again and make a finished grade testing between 60 and 62 per cent. metallic zinc. Two Kirksy tables just installed in the mill are making a big saving in the sludge.

Kennedy—The No. 2 mill was put into commission recently, thus increasing the milling capacity from 150 to 300 tons of concentrates per week. Gasolene power is used in the new mill and steam power in the old plant. The Kennedy was the second mine in the district to be equipped with a modern concentrator, and has been one of the biggest and steadiest shippers in the last eight years.

Klondike—Cleveland parties who secured this lease are breaking ground for the erection of a dry separating plant of the Sutton, Steele & Steele type. Four tables will be installed, calculated to handle about 50 tons of dirt per shift. Ore tests from this property were made recently at Dallas, Texas.

Washburn—This company has company has completed a 50-ton mill on its property, 14 miles north of Platteville, installing gasolene power.

Wyoming

NATRONA COUNTY

North American Asbestos Company—At this company's asbestos mine on Casper mountain, seven miles from Casper. the tunnel recently started is in 400 ft., intersecting the shaft at a point 75 ft. below the surface. The asbestos vein under development is 12 ft. wide at the shaft, and has a good fiber.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments.—Shipments of ore for the week ending Aug. 8 were as follows: Drummond, 66,800 lb.; La Rose, 184,000; Nipissing, 190,230; O'Brien, 191,760; Townsite, 41,000; Temiskaming, 100,600; Total 774,390 pounds.

Crown Reserve.—On Aug. 11 a find was made in the crosscut about 20 ft. from the main shaft at the 100-ft. level. Two nuggets of about 100 lb. each were taken out. A new compressor plant will soon be in operation.

La Rose.—On Aug. 12, a good strike was made on the Princess property of this company which adjoins the McKinley-Darragh, Silver Queen and Hudson Bay companies. Several veins were encountered in the northeast drift at a depth of 60 ft.; one was 3 in. wide carrying smaltite, niccolite and native silver. A statement of the output for the months of June and July gives a total of 744 tons carrying 501,286 oz. silver and valued at $210.196.

Nipissing..—Two new strikes have been made in the Myers and Fourth of July veins in the property lying in Cobalt. The strike in the Myers vein was in the west drift at a depth of 105 ft., the vein is 4 in. wide and shows calcite and native silver. A good showing of silver was found in the shaft of the Fourth of July vein at a depth of 75 feet.

ONTARIO—WAHNAPITAE

Crystal.—A gold bar valued at $400, has been received in Toronto, the result of the treatment of 56 tons of ore from this mine.

NOVA SCOTIA

Boston-Richardson.—This mine at Goldboro, the largest gold mine in Nova Scotia, has gone into liquidation and is in the hands of a receiver. The liabilities of the company amount to about $52,000 on current account.

North Atlantic Collieries.—The well-known Blockhouse seam has been struck at a depth of 125 feet on the north shore of Cow bay. It was found to be about 9 ft. 9 in. thick.

ONTARIO—VERMILION LAKE DISTRICT

Northern Pyrites Company—Development work is being steadily carried on; the shaft is down 200 ft. with drifts and crosscuts at the 100-ft. level. A Lidgerwood hoist and 5-drill duplex compressor are in operation. The vein is 60 ft. wide with good sulphur content, but owing to transportation difficulties no ore is at present being taken out except in development. Upon the completion of the Grand Trunk Pacific Railway, the mine will be connected by a spur.

ONTARIO—OXFORD COUNTY

Oxford Oil and Gas Company—This company, which is being incorporated with an authorized capital of $250,000, has been prospecting for some time near Innerkip, where it holds leases covering 5000 acres. Serious obstacles were en-

countered owing to a flow of water, but recently natural gas was struck at a depth of 1000 ft. There was 800 ft. of water in the hole, but the flow of gas was so strong that it forced the water up 200 ft. from the surface. Five drills will be started boring more wells. It is the intention of the company to pipe the gas to Woodstock, Ingersoll, London and other places.

NOVA SCOTIA

Dominion Coal Company—The output of coal for July was 364,673 tons, the largest for any month of this year. For the seven months ended July 31 the total was 2,051,985 tons in 1907, and 2,284,556 in 1908; an increase of 232,571 tons.

Mexico

CHIHUAHUA

Mexicana - Urique — This recently organized New York company has begun operations at several properties in the Urique district. John Paul is the manager in charge. The president and secretary are respectively Edward S. Beach and Karl H. Behr, both of New York city.

Rio Plata—The June production of this company's Santa Barbara mine near Guazapares was about 93,000 oz. silver in concentrates. It is the plan to have the cyanide plant in readiness toward the close of the year.

Los Lamentos—The Seawell-Robinson properties in this lead-silver district, reached from Moctezuma station on the Mexican Central, have lately been bonded to Geo. P. Squires and El Paso associates. It is the plan to carry on extensive work shortly.

Eucinillas—J. L. Saint-Dizier has succeeded M. J. de Morambert as manager of this company's smelting and mining interests. The Santa Rosalia smelter has not yet been blown in.

Coyame—Henry Faivre lately made another shipment of high-grade zinc ore from his property in this section to the east of Chihuahua, along the Orient railroad.

Chihuahua Copper Mining Company—This company is producing about 350 tons of copper concentrates, which carry considerable nickel. The property is near Falomir in the eastern part of the state. R. D. McCausland is president of the company.

Columbia—It is reported that this property in the Terrazas copper camp has been bonded to Corrigan, McKinley & Co., of Cleveland, Ohio, who are operating neighboring property under the organization known as the San Rafael Mining Company. The Columbia was formerly owned and operated by the Federal Copper Company, of El Paso. The San Rafael company's work is in charge of R. B. Hutchinson as managed and Capt. M. D. Murray as superintendent.

Candemania—These old silver mines in the Ocampo district are producing approximately 20,000 pesos monthly. The treatment process is lixiviation, following amalgamation. J. Royval is the owning operator.

Parral Production—The production of the Parral camp for the week ending Aug. 1 amounted to 9290 tons, of which 5040 tons were locally treated and the balance shipped to outside smelters. The July output was 28,935 tons.

HIDALGO

Amalgamated Mining and Milling Company—This company, capitalization 5,000,000 pesos, has been organized to operate a group of old mines in Pachuca. The stock is to be floated by one of Thomas W. Lawson's Boston companies.

JALISCO

Virginia—The mill and plant in the Hostotipaquillo district have been delayed, but construction work is again being hurried, and the plant will be running before the end of the year, according to the management. Fine grinding, air agitation and vacuum filters are features which are expected to reduce the time of treatment of the silver ore.

MEXICO

Oro Nolan—A 400-h.p. pump has been contracted for, and another of similar size will be purchased by the Dos Estrellas company. Recent discoveries in the Esperanza offer encouragement to those who believe that the mines of the El Oro district have not been bottomed.

Victoria—A new company has been formed to operate this mine in the El Oro camp. This mine was formerly thought highly of while the Dos Estrellas vein was being worked. When this was lost new backing was needed and the new company, composed of English capitalists, will try to find the lost vein.

OAXACA

México Mines-Prospects Company—At the San José de Gracia property, 30 miles from Oaxaca, the mill is in operation and experiments are being made to cyanide an old accumulation of tailings. At present the mill can only concentrate.

Europe

SPAIN

Exports of metals from Spain for the five months ended May 31 are reported by the *Revista Minera* as below, in metric tons:

	1907.	1908.	Changes.
Pig and manu. iron	21,222	13,432	D. 7,790
Copper	3,151	5,192	I. 2,041
Copper precipitate	7,133	8,789	I. 1,656
Zinc	744	411	D. 333
Lead	82,723	75,230	D. 7,493
Quicksilver	1,468	1,262	D. 206

There was a considerable increase in copper, but decreases in lead and quicksilver. Exports of minerals were as follows, in metric tons:

	1907.	1908.	Changes.
Iron ore	3,954,427	3,349,858	D. 604,569
Copper ore	581,941	516,126	D. 65,815
Zinc ore	76,897	44,592	D. 32,305
Lead ore	2,494	1,396	D. 1,098
Manganese ore	36,186	9,997	D. 26,189
Pyrites	559,474	645,634	I. 86,160
Salt	222,768	301,582	I. 78,814

Imports of phosphate of lime were 29,489 tons, an increase of 13,129 tons; of Thomas or basic slags, 34,774 tons, a decrease of 3839 tons. Imports of sulphur this year were 6110 tons and exports 3 tons.

Asia

INDIA—MYSORE

Kolar Goldfield—Gold production in July was 43,975 oz. bullion, an increase of 157 oz. over June. For the seven months ended July 31 the total was 304,361 oz. bullion in 1907, and 305,068 oz. in 1908; an increase of 707 oz. The bullion reported this year was equal to $5,675,176, or 274,561 oz. fine gold.

Other Mines—This year two mines—the Hutti Nizam and the Dharwar Reefs—have been producing outside the Kolar district. Their output is reported at 1887 oz. in July and at 12,595 oz.—or $260,339—for the seven months ended with July.

KOREA

Recent advices from Seoul, Korea, report that the mining laws of Korea have been changed by the Japanese authorities in a manner which will be advantageous to new enterprises. In future all mining machinery used in the development of mines and material necessary will be admitted free of duty. The export duty on copper will be abolished, and as soon as the state of the treasury permits, all minerals will be freed from export duty. Other changes in the mining law provide for the absolute security of investments in mines and other properties for all foreigners in Korea. In other words, the laws and regulations have been made so explicit that in future they will not be open to misconstruction. It is hoped that these changes will attract foreign capital to Korea.

Australia

NEW SOUTH WALES

The gold production in July is reported at 29,649 oz. fine, an increase of 4390 oz. over July, 1907. For the seven months ended July 31 the total was $3,324,439, or 160,834 oz. fine gold.

QUEENSLAND

Gold production in July is cabled as 44,900 oz. fine gold, or $928,083. The ore crushed is reported at 64,300 tons.

WESTERN AUSTRALIA

The gold production in July was 133,424 oz. fine, a decrease of 3284 oz. from June. For the seven months ended July 31, the total was 966,810 oz. in 1907, and 960,443 oz.—or $19,852,357—in 1908; a decrease of 6367 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Aug. 19—In the West the event of the week is the strike of the miners in the Indiana bituminous district. The present indications are that it may be a prolonged trial of strength between the operators and the miners' union. It will affect business to some extent, though Illinois and Ohio mines are quite able to make up any shortage in the supply which may be caused. The strike is referred to fully on another page.

In the East trade is duil, both in bituminous and anthracite coal. Little business is being done, and prices are weak. The Coastwise trade is quiet.

The Navy Department has let a contract for 15,000 tons of coal for the Pacific fleet to Barber & Co., New York, at $7.30 per ton, delivered at Magdelena Bay and at Bremerton, Washington.

The scarcity of water supply, owing to continued drought, is interfering with the operation of many collieries in the anthracite region; and also with some in the Clearfield bituminous district in Pennsylvania.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Aug. 8, in short tons:

	1907.	1908.	Changes.
Anthracite	3,438,072	3,085,670	D. 352,402
Bituminous	23,199,063	19,462,584	D. 3,736,479
Coke	8,530,512	4,061,666	D. 4,468,846
Total	35,167,647	26,609,920	D. 8,557,727

Total decrease this year to date, 25.2 per cent.

Receipts of coal at Boston, seven months ended July 31, reported by Chamber of Commerce:

	1907.	1908.	Changes.
Anthracite	1,237,408	1,025,279	D. 212,129
Bituminous	1,792,430	1,838,791	I. 46,361
Total domestic	3,029,838	2,864,070	D. 165,768
Foreign	310,605	247,550	D. 63,055
Total	3,340,443	3,111,620	D. 228,823

The foreign coal received comes chiefly from Nova Scotia.

New York

Anthracite

Aug. 19—There is no activity in the hard-coal market either in prepared or small steam sizes. On Sept. 1 the winter rates for prepared coal will be in force and at this time there is usually considerable business; but this year consumers are not availing themselves of the lower prices. Possibly this is due to the fact that prepared sizes are selling below circular prices. The hard-coal movement to upper Lake ports has been quite active this week.

Quotations by the large dealers are as follows: Broken, $4.65; egg, stove and chestnut, $4.90; pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2, or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

There is nothing encouraging to report in the soft-coal trade. Throughout all consuming territories dullness prevails and consumers are not anxious about taking on coal. In New York harbor there is no market and good grades of steam coal are offered at $2.40@2.45; there does not seem to be any offerings of even the poorer grades at as low a price as last week, the lowest being $2.35 per ton. Transportation from mines to tide is fair and cars are again plentiful. In the Coastwise vessel trade freight rates are firmer, but no advance has been made. It was reported that the rate from Newport News to Boston had advanced to 60c., but this report is unconfirmed and, moreover, vessels have been offered at 50c. per ton. Freight rates for large vessels from Philadelphia are as follows: To Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Newburyport, Gardiner and Bangor, 70@75c.; Portsmouth, 55@60c.; Saco, 90@$1; to the Sound, 45@50 cents.

Birmingham

Aug. 17—Coal production in Alabama is improving by degrees, as new labor is brought into the district and put to work. The production, however, is far from normal. The military and special guards are still on duty in the mining fields throughout the coal-bearing section. The Operators' Association, at a meeting held the past week, declared that there was no question for arbitration, that it was intended to operate the mines on the open-shop plan and under no consideration would there be dealings with the union. National Vice-President John P. White, of the United Mine Workers of America, has issued a statement that the strike is far from being lost.

Coal and coke both are being brought into the Birmingham district in order that there be no delay at the furnaces and other plants, the home supply not being sufficient.

Chicago

Aug. 18—The coal market shows activity in the harvesting business and some lines of domestic coals show improvement. Steam trade is still dull. Eastern coals in general are much better regulated as to shipments, and Western coals are not so badly affected by shipments on which demurrage causes sacrifice sales as in former years.

Indiana and Illinois lump is finding increasing sale at $1.75@2.25 in car-lots; run-of-mine brings $1.60@1.70 and screenings, $1.35@1.50. The market for fine coals is not so strong as a week or two ago. Brazil block is in fair demand at $2.25@2.35.

Smokeless still runs 20 or 25c. off circular price of $3.30 for run-of-mine. Hocking is strong, the best firm at $3.15, with no surplus on tracks. Youghiogheny is quiet at $3.15@3.25.

Anthracite shows practically no change.

Pittsburg

Aug. 18—Production shows a slight decline this week, due chiefly to the closing of a number of the river coal mines on account of the large stocks awaiting shipment. Many railroad mines are running on slow time. Slack continues to be a drug, and sales have been made at less than 40c. Mine-run coal on contract continues to be held at $1.15 at mine, and there are no reports of shading, although it is possible a producer might make a concession rather than close his mine.

Connellsville Coke—Conditions show some improvement and several independent interests have increased operations. The H. C. Frick Coke Company also has fired more ovens. Sales of furnace coke at slightly reduced rates are still being made by some interests that cannot hold it, but these have been few. There is no drop in the regular quotations of foundry coke, $2.10@2.25 on contract; furnace coke $1.65@1.75 at ovens. The Pickands-Magee Coke Company has made several important contracts for both foundry and furnace coke. One of them calls for 25,000 tons for delivery through the year. The *Courier* gives the production in both Connellsville fields at 192,845 tons. Shipments, 7226 cars as follows: To Pittsburg, 3147; to points west of Connellsville, 3723; to points east of Connellsville, 356 cars.

Foreign Coal Trade

Spanish Fuel Imports—Imports of coal into Spain, five months ended May 31, were 798,934 metric tons, a decrease of

55,925 tons from last year. Imports of coke, 137,695 tons, an increase of 35,287 tons.

Belgian Coal Production—Coal production of Belgium, six months ended June 30, metric tons:

	1907.	1908.	Changes.
Coal mined.....	11,868,655	11,813,650	D. 55,005
Stocks, June 30....	459,101	919,060	I. 459,959

The decrease in coal mined and increase in stocks show an apparent decrease of 514,964 tons in consumption. Number of men employed, 140,863 in 1907, and 144,176 this year.

German Coal Production—Output of coal in Germany, six months ended June 30, metric tons:

	1907.	1908.	Changes.
Coal	69,571,431	72,695,452	I. 3,124,021
Brown coal.....	29,602,022	32,047,323	I. 2,445,301
Total mined....	99,173,453	104,742,775	I. 5,569,322
Coke made.....	10,629,561	10,612,140	D. 17,421
Briquets made...	7,721,908	8,765,208	I. 1,043,300

Of the briquets reported this year 6,805,213 tons were made of brown coal, or lignite.

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of Welsh coal as follows, on Aug. 8: Best Welsh steam, $4.20; seconds, $3.96; thirds, $3.66; dry coals, $3.84; best Monmouthshire, $3.60; seconds, $3.36; best small steam, $2.34; seconds, $2.04. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Aug. 19—Improvement in the iron market is slow. There has been a little more inquiry for pig iron, especially for basic, but buyers are still looking for bottom prices. In foundry the Southern makers are best provided with orders, some being practically out of the market.

In finished material more specifications are reported. There is some structural business coming forward; but contractors are still taking business at prices which indicate lower rates for material. A possible large order for steel cars for the Southern Pacific lines is attracting a great deal of attention. No rail orders of any size are pending.

Baltimore

Aug. 17—Exports for the past week included 857,106 lb. tin scrap to Germany and 3004 lb. aluminum sheets to Great Britain. Imports included 225 tons ferromanganese and 16 casks silicospiegel from Liverpool. Receipts of iron ore were 5300 tons from Cuba.

Birmingham

Aug. 17—Southern manufacturers of pig iron are enjoying a better demand for iron. No. 2 foundry is selling in small lots at $12.50 per ton, the larger consumers reporting purchases at $12 per ton. The home consumption is healthy. The make has been improved by the blowing in of a furnace at Ironton, belonging to the Alabama Consolidated Coal and Iron Company. The Sloss-Sheffield furnace at Florence is not quite ready. The Tennessee company will, within 30 days, be ready to start up one or two furnaces at Ensley.

The Tennessee company will start up its Bessemer, Ala., rolling mills this week, giving employment to 300 men. The day's record in steel-rail making was broken during the past week when 1504 tons of rail were produced at Ensley.

Cast-iron pipe and other foundries are busy. Other concerns using pig iron are doing better now than for some time.

Chicago

Aug. 18—Buying of pig iron continues to be small; but considering that we are in the dull season of midsummer it is not discouraging. Lots of a carload to 500 tons are most numerous, and are chiefly for delivery in the next three months. Future-delivery orders—for the first half of 1909—are not numerous, but inquiries increase.

Southern No. 2 foundry is not selling below $12 Birmingham ($16.35 Chicago), on any but extraordinary orders. For most business $12@12.50 Birmingham has obtained. The tone of the market is decidedly stronger as regards contract requirements—those for deliveries more than 30 days hence. Some quotations in good faith run up to $13 Birmingham, or $17.35 Chicago.

Northern iron remains about $17@17.50, though this also has a tendency to stiffen. Northern charcoal iron is a little less in demand at $19.50@20.50, and the production limited closely.

For iron and steel products the market is in general, dull. Coke is quiet at $4.90 for first-class Connellsville.

Philadelphia

Aug. 19—The most significant feature of the pig-iron market is the many evidences of the depletion of stocks among holders. The most discouraging feature is the large idle capacity. Careful inquiry among consumers shows an irregular increase in consumption. Orders coming to furnace offices are for less than 100 tons generally. Scarcely any of the larger concerns are buying yet for fourth-quarter delivery, and their needs up to Oct. 1 are supplied. The cast-iron pipe makers continue to catch large orders and they cover immediately. No. 2 foundry is quoted at $16; gray forge sold today at $15.50; basic is $15.50.

Steel Billets—Manufacturers of billets are anxious to obtain orders, but buyers want them to shade about 50 cents.

Bars—The city bar-iron men are taking a philosophic view and expect no improvement. Refined iron is about all that is selling.

Sheets—Manufacturers have succeeded in gathering in a fair amount of autumn-delivery business, mostly from stores.

Pipes and Tubes—Our consumers are doing a little more work, but not enough to make an impression.

Structural Material—Some good business has come this week for immediate delivery.

Scrap—There are calls for heavy steel scrap and large lots could be sold, but buyers will not pay the prices asked. The stocks available are not heavy. Railroad scrap keeps moving at holders' own terms.

Pittsburg

Aug. 18—There has been no material change in the iron and steel markets during the week, but there has been some improvement. In several of the finished lines demand has fallen off, but in others there is an improvement. The general average of the mills in Pittsburg may be safely put at around 60 per cent. of capacity. In the finished material being figured on are 7000 steel cars for the Harriman lines and several hundred miles of 12-in. line pipe for the Standard Oil Company. More new business is being booked by the Carnegie Steel Company, which has necessitated an increase in its pig-iron production. More mills are on at the Homestead and Duquesne plants. The Clairton and the Edgar Thomson plants are running to about 35 per cent. of capacity. Additional tinplate mills have been closed, reducing the number owned by the American Sheet and Tin Plate Company to 126 active and 116 idle. The independent companies are doing fairly well in both sheets and tinplate. In order to give its idle members an opportunity to get to work the strikes at the Washington Tinplate Company, Washington, Penn., and the Standard Tinplate Company, at Canonsburg, Penn., have been declared off by the Amalgamated Association.

Pig Iron—There is no improvement in pig-iron prices, but inquiries and sales are more satisfactory. The contract for 4000 tons of malleable bessemer is still pending. The Standard Sanitary Manufacturing Company has increased its order for foundry and forge iron from 8400 to 9600 tons, for September and October delivery. The lowest price so far named on bessemer was $15.35, at furnace, for 200 tons. Quotations for third-quarter delivery are: Bessemer, $15.40@15.50; malleable bessemer, $15; basic, $14.75@15; No. 2 foundry, $14.50@14.75; gray forge, $13.75@14, all at Valley furnaces.

Steel—Several fair sales of bessemer and open-hearth billets have been made at the regular price of $25, Pittsburg. Sheet and tinplate bars are still quoted at $27.50; plates, 1.60c.; steel bars, 1.40c., Pittsburg.

Sheets—More mills are running. Prices firm, black sheets, 2.50c. and galvanized sheets 3.55c., for No. 28 gage.

Ferro-Manganese—For prompt shipment has declined 50c., Pittsburg, sales having been made at $45. For future shipment $46 can be done.

Sault Ste. Marie Canal

The freight passing through the Sault Ste. Marie canals, to and from Lake Superior, for the season to Aug. 1 is reported as follows, in short tons:

	1907.	1908.	Changes.
East-bound	18,906,348	8,759,790	D. 10,146,558
West-bound	6,075,207	4,330,684	D. 1,744,523
Total	24,981,555	13,090,474	D. 11,891,081

The decrease in east-bound tonnage was 53.7 per cent.; west-bound, 28.7; total, 47.6 per cent. The number of vessel passages this year was 5841, showing an average cargo of 2,242 tons. The mineral freights included in the totals above were, in short tons, except salt, which is in barrels:

	1907.	1908.	Changes
Coal	5,512,821	3,869,451	D. 1,643,371
Iron ore	16,364,443	7,106,322	D. 9,258,121
Pig and manuf. iron	140,480	121,055	D. 19,425
Copper	35,291	35,960	I. 669
Building stone	100	577	I. 477
Salt, bbl	402,227	308,737	D. 93,490

The chief decreases were in iron ore and coal. Iron ore formed 54.3, and coal 29.6 per cent. of the total tonnage this year.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports the production of pig iron in June at 956,425 metric tons, being 54,492 tons less than in May, and 87,911 tons less than in June, 1907. For the half-year ended June 30 the production was, in metric tons:

	1907.	1908.	Changes.
Foundry iron	1,095,225	1,122,890	I. 27,665
Forge iron	394,680	349,506	D. 45,174
Steel pig	501,687	501,962	I. 275
Bessemer pig	2 5,788	211,533	D. 24,255
Thomas(basic)pig	4,128,573	3,863,830	D. 264,743
Total	6,355,953	6,049,721	D. 306,232

Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Aug. 19.
At all U. S. Ports in July and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1908..	$ 4,845,272	$ 2,916,408	Exp. $ 1,928,864
" 1907..	7,478,366	3,410,782	" 4,067,584
Year 1908..	58,363,247	29,324,304	" 29,038,943
" 1907..	43,779,098	24,879,429	" 18,899,669
Silver:			
July 1908..	4,930,746	2,982,074	Exp. 1,948,672
" 1907..	5,955,042	3,387,225	" 2,567,817
Year 1908..	30,445,291	24,123,422	" 6,321,869
" 1907..	35,174,251	25,782,836	" 9,391,415

Exports of specie from New York, week ended Aug. 15: Gold, none; silver, $886,745, nearly all to London. Imports: Gold, $151,873 from the West Indies, Central and South America; silver, $51,565, from the West Indies and Mexico.

Foreign trade of the United States, as reported by the Bureau of Statistics, Department of Commerce and Labor, seven months ended July 31:

Merchandise:	1907.	1908.
Exports	$1,068,999,907	$ 980,997,732
Imports	875,901,076	608,857,471
Excess, exports	$ 193,098,831	$ 372,140,261
Add excess of exports, silver		6,321,869
Add excess of exports, gold		29,038,943
Total export balance		$ 407,501,073

The gold and silver movement in detail is given in the table at the head of this column.

Specie holdings of the leading banks of the world, Aug. 15, are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$324,635,900
England	$182,754,515	.....	182,754,515
France	644,227,355	$181,250,200	825,477,555
Germany	196,185,000	81,305,000	277,490,000
Spain	78,405,000	135,290,000	213,695,000
Netherlands	38,523,500	21,116,000	59,640,000
Belgium	20,493,335	10,246,665	30,740,000
Italy	183,680,000	22,000,000	205,680,000
Russia	577,640,000	39,970,000	617,610,000
Aust.-Hungary	235,125,000	66,770,000	301,895,000
Sweden	20,150,000	.....	20,150,000
Norway	8,680,000	.....	8,680,000
Switzerland	21,°25,000	.....	21,525,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Gold and silver movement in France, six months ended June 30:

	Imports.	Exports.	Excess.
Gold	Fr.512,397,000	F.14,463,000 Imp.	Fr.497,934,000
1907	150,668,000	73,963,000 Imp.	76,705,000
Silver	75,635,000	84,248,000 Exp.	8,613,000
1907	81,785,000	82,301,000 Exp.	516,000

Silver Market

SILVER AND STERLING EXCHANGE.

August.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	August.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
13	4 8650	52	24 1/16	17	4.8645	51¼	23 1/16
14	4.8655	51¼	23 1/16	18	4.8645	51¼	23 1/16
15	4.8640	51⅛	23⅝	19	4.8645	51⅛	23⅝

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

The silver market has suffered a further fall the past week, the price dropping from 24 1/16 to 23⅝d. in London. The weakness has been due to sales by Bombay, and the market tendency still depends on India. The shipment of Sycee silver from Shanghai to Bombay has been a disturbing factor.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Aug. 6:

	1907.	1908.	Changes.
India	£7,316,924	£5,175,493	D. £2,141,431
China	.....	516,400	I. 516,400
Straits	544,012	90,510	D. 453,502
Total	£7,860,936	£5,782,403	D. £2,078,533

Receipts for the week were, £112,500 from New York; exports, £178,000 to India.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

August.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
13	13¾ @13⅞	13½ @13¾	60⅝	30½	4.57½ @4 60	4.67½ @4 72½	4 52½ @4 57½
14	13⅝ @13¾	13½ @13⅝	59¾	30¼	4 57½ @4.60	4.67½ @4 72½	4.52½ @4.57½
15	13⅝ @13¾	13⅝ @13½	....	30	4.57½ @4.60	4.65 @4.70	4 50 @4.55
17	13½ @13¾	13⅜ @13½	59⅞	29¼	4 57½ @4 60	4 65 @4 70	4.50 @4.55
18	13½ @14¾	13⅜ @13½	60 1/16	29½	4.57½ @4 60	4 65 @4.70	4.50 @4.55
19	13½ @13¾	13⅜ @13½	60⅞	29 1/2	4.57½ @4.60	4 65 @4 70	4.50 @4.55

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Since Aug. 12 the market has been very dull, the transactions that have been made, both in Lake and electrolytic, having been chiefly in copper from second hands. Considerable sales of this copper have been made at the lower of the range of prices, and even under the quotations. As to first hands, one of the large producers was offering electrolytic copper at 13½c. up to Saturday, but it then withdrew and since has been holding aloof along with the other producers, who are asking prices somewhat higher than buyers at present are willing to pay. It is expected that liquidation of speculative accounts, now apparently about completed, will be followed by another upward turn in the market, as to which the sentiment is optimistic. The market closes at 13½@13¾c. for Lake, and 13⅜@13½ for electrolytic in cakes, wirebars or ingots, and 13⅛@13¼ for casting copper.

Credence is given the reports that Wall Street operators had considerable commitments in the London standard market, which they liquidated when prices broke on the Stock Exchange last week. Refined copper had also been largely bought on speculation, and the decline in London scared the holders into selling. Consumers, who had supplied themselves liberally in previous weeks, were not in a hurry to relieve them and forced concessions in prices, which are really somewhat out of proportion with the quantities involved. When the increase in the statistics of 2600 tons was published, it turned out that the bad effect had been thoroughly discounted in the standard market, and since then there has been a recovery, the market closing firmer at £60 17s. 6d. for spot and £61 2s. 6d. for three months prompt.

Refined and manufactured sorts we

quote: English tough, £63 10s.@64 10s.; best selected, £63 10s.@64 10s.; strong sheets, £75 10s.@76 10s.

Manufactured Copper—Sheets, cold-rolled, 19c.; hot-rolled, 18c. Wire, 15¼c. base. It is reported that these prices are being shaded.

Tin—Advices of large shipments from the East during the first half of the month served to depress the market, which, however, closes somewhat above the lowest, at £133 for spot and £133 15s. for three months prompt.

There is no life in the domestic market, and even the lower prices did not attract buyers. Spot tin at the close can be bought at about 29½ cents.

Lead—Business is of small proportions, and the market is quoted at 4.57½@4.60c. New York.

The London market is again lower and barely steady at £13 7s. 6d. for Spanish lead and £13 8s. 9d. for English.

Spelter—There has been no material change. Every order is eagerly competed for and prices have suffered a further decline to 4.65@4.70c. New York and 4.50@4.55c. St. Louis.

The London market is also somewhat weaker, and the close is cabled at £19 10s. for good ordinaries and £19 15s. for specials.

Zinc Sheets—Base price is 7c. f.o.b. La Salle-Peru Ill., less 8 per cent.

Other Metals

Antimony—The market abroad is weak, and in New York no business is being done. Quotations are 8¼c. for Cookson's, 8@8⅛c. for Hallett's, and 7⅞@7⅞c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base. Occasional offers of foreign metal are reported.

Cadmium—In 100-lb. lots, $1.25 per lb., at Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York price is lower, at $42.50 per flask for large lots, and $44 for jobbing orders. San Francisco is nominal at $42 for large orders, domestic delivery, and $40@40.50 for export. London, £17 7s. 6d. per flask, with 1s. 3d. less quoted from second hands.

Platinum—Prices remain unchanged at $22.50 per oz. for hard platinum, $20 for ordinary and $15 for scrap.

Wisconsin Ore Market

Platteville, Wis., Aug. 15—The current price for 60 per cent. zinc ore this week was on a basis of $36@37 per ton for 60 per cent. zinc. For 80 per cent. lead ore $61 per ton was paid. The ore shipment this week comprised more high-grade zinc than for several weeks past, the higher base price inducing several companies to let go of a portion of their reserve stock. The Acme and Empire roasters at Platteville are again in commission.

Shipments of ore, week ended Aug. 15:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	308,090	48,640	.....
Platteville	238,000	.....	176,000
Galena	235,300	.....	.....
Cuba City	235,130	.....	.....
Linden	163,110	.....	.....
Livingston	160,000	.....	.....
Days Siding	143,400	.....	.....
Highland	119,400	.....	.....
Mineral Point	26,400	.....	.....
Harker	.....	82,040	.....
Total	1,628,830	130,680	176,000
Year to Aug. 15.	56,505,561	6,808,605	1,262,014

Harker shipped the previous week 104,030 and Mineral Point 150,000 lb. zinc ore, not then reported, but now included in the totals for the year. Shipments to electrostatic separator, Platteville, 332,800 lb.; to Joplin Separator Works, Galena, 261,800 lb.; to Enterprise roaster, Platteville, 185,000 lb. zinc concentrates.

Missouri Ore Market

Joplin, Mo., Aug. 15—The highest price paid for zinc was $39, the assay base ranging from $37 to $36 per ton of 60 per cent. zinc, and the average price, all grades was $34.12. A base of $37.50 was rumored. The highest price paid for lead ore was $63, medium grades selling at $61 @ 62, and all grades averaging $61.76 per ton.

The shipment was again heavy, this week, exceeding last week by 240 tons of zinc and 162 tons of lead ore, and exceeding the zinc content fully 1000 tons. All reserve stock for sale on the present level of prices has been sold and most of it is now delivered. It is reported here that the smelter owners are preparing to fire additional blocks. Buyers are nearly all looking for a quieter market next week, as the smelters have accumulated stocks during the past three weeks of heavy buying.

Following are the shipments of zinc and lead from the district for the week ending Aug. 15:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,519,370	1,203,030	$115,245
Joplin	2,954,140	188,640	58,927
Galena	598,750	106,520	13,877
Alba-Neck	643,560	.....	11,594
Granby	594,600	60,160	9,700
Prosperity	323,010	106,110	8,941
Duenweg	291,190	108,210	8,376
Spurgeon	354,830	111,650	7,758
Oronogo	370,780	.....	6,569
Carthage	288,630	.....	5,195
Zincite	186,190	.....	3,165
Quapaw-Baxter	199,700	.....	2,905
Badger	182,570	.....	2,921
Aurora	160,500	7,440	2,357
Carl Junction	83,010	3,410	1,598
Sarcoxie	60,320	.....	1,085
Playter	54,130	.....	866
Miami	58,790	.....	823
Totals	11,924,070	1,895,170	$261,992
33 weeks	307,661,640	48,217,710	$6,499,720
Zinc value, the week, $203,468; 33 weeks,			$5,174,225
Lead value, the week, 58,524; 33 weeks,			1,325,495

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April	48.24	34.08	April	79.76	52.47
May	45.98	33.39	May	79.56	56.05
June	44.82	32.07	June	73.66	60.48
July	45.79	31.67	July	58.18	59.90
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43 40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Chemicals

New York, Aug. 19—The general chemical market is unchanged and spot business is not heavy. Prices hold firm, but inquiries are not over-abundant.

Copper Sulphate—Shading of prices has ceased and the salt is held firmly at $4.65 per 100 lb. for carloads and up to $4.90 for smaller lots.

Nitrate of Soda—Little or no business has been forthcoming and trade has been in small lots for prompt delivery. Prices are about 2.30 c. for spot and 2.25 @ 2.35c. for futures.

Phospates—Paul C. Trenholm reports the shipments of phosphate rock from Charleston, S. C., by rail in July at 5713 long tons. No coastwise shipments.

Mining Stocks

New York, Aug. 19—The Stock Exchange has been variable through the week, but generally active, with fluctuations in both directions that are plainly the result of large professional operations. It closes with business heavy, prices irregular and no definite tendency apparent.

The curb market has been generally active, with a good demand for copper stocks. Nevada Consolidated was the leader and made some gains on large sales. Other copper stocks also sold well. The Nevada gold stocks were only moderately active. Cobalt stocks were dealt in to a large extent. The close in the curb market was rather strong.

Boston

Aug. 18—There has been some let-up in the market and a softening of prices, but the tone remains good. The Lawson campaign has undoubtedly been reflected to some extent in the course of prices. Today saw some renewed interest taken and the Lake stocks displayed buoyancy, which may indicate that the shell has been broken. Amalgamated broke from $81.87½ a week ago, to below $75, but has recovered to $78. North Butte broke $4.50 to $79.50, but has more than recovered the loss, even though the dividend rate was maintained at $1 for the quarter. Calumet & Arizona fell $8.75 to $119, recovering $3 of it. Dividend action by this company will be taken shortly.

In the Michigan group, Adventure has been well bought, having risen $2 to $10.75. Centennial spurted $6 to $36.25 on slight buying orders, and Isle Royale rose $2 to $23. Mass spurted to $7.37½. Lawson's Trinity ran off $2.50 to $17.50, recovering to $21. Utah Consolidated broke $3.50 to $45, recovering partially, and Butte Coalition reacted to $26.50. Old Dominion fell $2 to $39, with subsequent recovery.

It is believed that the successful floating of the North Lake will bring out other properties in that vicinity. Davis Daly affairs will now be put in shape, although it will cost the company a 15 per cent. commission to have the $2 assessment underwritten.

San Francisco

Aug. 14—A somewhat unusual thing for California gold mines is the listing on the San. Francisco Stock and Exchange Board of the Hazel Mining Company, which owns quartz mines in Siskiyou and Shasta counties. Its most noted mine is the Gladstone, in French gulch, Shasta county, which is a steady producer, having yielded altogether over $1,250,000 in gold.

Some of the San Francisco mining stock brokers are about to purchase seats in the Stock Exchange at Seattle, Wash., which begins operations Sept. 1. The main business at first will be in mining stocks, but industrial quotations will also be furnished. It is stated that steps will be taken to assure the listing of only bona fide mining companies.

STOCK QUOTATIONS

NEW YORK Aug. 18	
Name of Comp.	Clg.
Alaska Mine	9/16
Amalgamated	78
Anaconda	47⅜
Balaklala	2
British Col. Cop.	6⅞
Butte & London	....
Butte Coalition	27⅛
Colonial Silver	½
Cum. Ely Mining.	8¾
Davis Daly	2¾
Dominion Cop	2½
Douglas Copper	4⅜
El Rayo	3
Florence	3⅜
Foster Cobalt	.42
Furnace Creek	.18
Giroux	4½
Gold Hill	½
Goldfield Con.	6 1/16
Granby	102
Greene Gold	⅜
Greene G. & S	¼
Greenw'r & D.Val.	.75
Guanajuato	2½
Guggen. Exp.	177
Hanapah	‡ 20
McKinley Dar.	⅞
Micmac	2⅝
Mines Co. of Am.	1 1/16
Mitchell Mining.	1½
Mont. Sho.C	¾
Nev. Utah M. & S	3½
Newhouse M. & S	6⅛
Nipissing Mines	9
Old Hundred	½
Silver Queen.	1.04
Stewart	⅞
Tennessee Cop'r.	37
Tri-Bullion	1⅛
Union Copper.	1 1/16
Utah Apex	4⅛
Utah Copper	44½
Yukon Gold	5

*Ex. Div. †Ex. Rights.

BOSTON Aug. 18	
Name of Comp.	Clg.
Adventure	10¾
Allouez	58½
Am. Zinc.	29
Arcadian	4
Arizona Com	22
Atlantic	14
Bingham	.60
Boston Con	‡4
Calumet & Ariz.	123
Calumet & Hecla	685
Centennial	36
Con. Mercur	.43
Copper Range	77½
Daly West	10
Franklin.	12
Greene Can.	11⅜
Isle Royal	23¼
La Salle	14⅝
Mass	7½
Michigan	12½
Mohawk	67
Nevada	15½
North Butte	‡4
Old Colony.	.50
Old Dominion	41
Osceola	111
Parrot	27
Quincy	96
Rhode Island	4
Santa Fe	2
Shannon	15¼
Superior	24
Tamarack	71
Trinity	21¼
United Cop., com.	11
U. S. Oil	26¾
U. S. Smg. & Ref.	42¼
U.S.Sm. & Re.,pd.	45¾
Utah Con.	46½
Victoria	5½
Winona	6½
Wolverine	142
Wyandotte.	2

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	24⅛
Am. Smelt. & Ref.	94¼
Am. Sm. & Ref., pf.	107⅛
Bethlehem Steel	22
Colo. Fuel & Iron	34¼
Federal M. & S.,pf.	‡87
Inter. Salt	18½
National Lead	86⅜
National Lead, pf.	‡104
Pittsburg Coal	‡12
Republic I. & S.	23¼
Republic I. & S.,pf.	78
Sloss-Sheffield	63
Standard Oil	648
U. S. Red. & Ref.	‡15¼
U. S. Steel	46
U. S. Steel, pf	109
Va. Car. Chem	28

BOSTON CURB	
Ahmeek	88
Black Mt	‡4½
East Butte	8⅛
Hancock Con	6⅜
Keweenaw	6¾
Majestic	.71
Raven	1
Shawmut	‡ 33
Superior & Pitts	13¼
Troy Man	‡.50

ST. LOUIS Aug. 15		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie.	05	.03
Center Cr'k	2 25	1.75
Cent. C. & C.	68.25	67 25
C.C. & C. pd.	78 00	76 00
Cent. Oil.	110 00	100.00
Columbia	5 00	4.00
Con. Coal.	19 00	17 00
Doe Run.	125.00	110.00
Gra. Bimet.	.20	.18
St. Joe.	15.00	13 00

LONDON Aug. 19	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd	0 1 0
Camp Bird	0 14 9
Esperanza	3 6 3
Tomboy	1 2 6
El Oro	1 8 0
Oroville	0 8 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Aug. 19.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.	.20
Belcher	.18	St. Ives	.32
Best & Belcher	.47	Triangle	.06
Caledonia	.14	BULLFROG STOCKS	
Challar	.17	Bullfrog Mining	.04
Comstock	‡.26	Bullfrog Nat. B	.05
Con. Cal. & Va	.72	Gibraltar	.05
Crown Point	.27	Gold Bar	.03
Exchequer	.27	Homestake King.	.27
Gould & Curry	.12	Montgomery Mt.	.09
Hale & Norcross	.21	Mont. Shoshone C.	.80
Mexican	.74	Original Bullfrog.	.02
Ophir	2.10	Tramp Cons.	.17
Overman	.10	MANHAT'N STOCKS	
Potosi	.10	Manhattan Cons	.08
Savage	.19	Manhat'n Dexter	.04
Sierra Nevada	.29	Jumping Jack	.03
Union	.26	Stray Dog	.04
Utah	.05	MISCELLANEOUS	
Yellow Jacket	.57	Golden Boulder	.07
TONOPAH STOCKS		Bonnie Clare	.09
Belmont	1 15	Lee Gold Grotto	
Extension	.88	Nevada Hills	1 62½
Golden Anchor	.02	Nevada Smelting	1 12½
Jim Butler	.28	Pittsburgh S. Pk	1 07
MacNamara	.57	Round Mt. Sphinx	20
Midway	.43		
Montana	1.43		
North Star	.10		
Tono'h Mine of N	7.62½		
West End Con	.66		
GOLDFI'D STOCKS			
Adams	.05		
Atlanta	.30		
Booth	.46		
Columbia Mt	.25		
Comb. Frac	1 39		
Cracker Jack	.06		
Dia'dfield B. B. C.	.18		
Goldfield Belmont	.15		
Goldfield Daisy	.75		
Great Bend	.35		
Jumbo Extension	.50		
Katherine			
Kendall	.15		
Lone Star	.11		
May Queen	.05		
Oro	.14		
Red Hill	.29		
Roanoke			
Sandstorm	.30		

COLO. SPRINGS Aug. 15	
Name of Comp.	Clg.
Acacia	6½
Black Bell	
C. C. Con	‡3¼
Dante	6⅛
Doctor Jack Pot.	7
Elkton	62¼
El Paso	38
Findlay	22
Gold Dollar	6½
Gold Sovereign	3
Isabella	29¼
Index	
Jennie Sample	2½
Jerry Johnson	‡4
Mary McKinney	25
Pharmacist	3⅛
Portland	98
Un. Gold Mines.	‡ 1⅞
Vindicator	85
Work	8

Assessments

Company.	Delinq.	Sale.	Amt.
Butler-Liberal, Utah	July 17	Aug. 6	$0 02
Caledonia, Nev	Aug. 12	Sept. 2	0.05
Challar, Nev	July 8	July 30	0.10
Exchequer, Nev	Aug. 11	Sept. 1	0.05
Helvetia, Ariz		July 20	0.50
Ingot, Utah	July 17	Aug. 5	0.01
Iowa Copper, Utah	July 13	July 30	0.05
Lead King, Utah	July 1	July 28	0.01
Little Chief, Utah	Aug. 11	Sept. 1	0.01
Lucky Calumet, Ida	July 3	Aug. 13	0.01
Maxfield, Utah	July 18	Aug. 17	0.02
Mexican, Nev	July 17	Aug. 17	0.10
Missoula Copper, Ida	July 25	Aug. 25	0.01
Oro Cobre, Cal	July 16	Aug. 3	0.02
Sierra Nevada	July 14	Aug. 4	0.10
Signet	Aug. 8	Oct. 6	0.01
Talisman, Utah	Aug. 1	Aug. 18	0.02
Tomahawk, Nev	July 10	Aug. 12	0.01
Wabash, Utah	July 10	Aug. 1	0.10
Wheeler, Utah	July 16	Aug. 6	0.01½

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68 673	55 678	31 769	25.738
February	68 835	56 000	31 852	25 855
March	67 519	55 365	31 325	25.570
April	65 462	54 505	30 253	25.133
May	65 971	52 795	30 471	24.377
June	67 090	53 663	30 893	24 760
July	68 144	53.115	31 366	24.514
August	68 745		31 637	
September	67 792		31 313	
October	62 435		28 863	
November	58 677		27 154	
December	54 565		25 362	
Year	65 327		30 188	

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24 404	13 726	24 825	13 901	106 739	62 386
February	24 869	12 905	25 236	13 098	107.356	58 786
March	25 035	12 704	25 560	12 875	106.594	58 761
April	24 224	12 743	25 260	12 928	98 625	58 331
May	24 048	12 598	25 072	12.788	102 375	57 387
June	21 665	12 675	24 140	12 877	97.272	57.842
July	22 130	12.702	21 923	12.933	95.016	57.989
August	18 356		19 255		79.679	
September	15 565		16 047		68 375	
October	13 169		13 551		60 717	
November	13.391		13.870		61 226	
December	13 163		13 393		60 113	
Year	20 004		20.661		87 007	

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41 548	27 380	July	41.091	29.207
February	42 104	28.978	August	37 667	
March	41 314	30.577	September	36 689	
April	40 938	31 702	October	32 620	
May	43 149	30 015	November	30 833	
June	42.120	28 024	December	27 925	
			Av. year.	38.166	

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6 000	3 691	19 828	14 469
February	6 000	3 725	19 531	14 250
March	6 000	3 898	19 703	13 975
April	6 000	3 993	19 975	13 469
May	6 000	4 253	19 688	12 938
June	5 700	4.466	20 188	12.600
July	5 288	4.447	20 350	13.000
August	5 250		19 063	
September	4.813		19 775	
October	4.750		18 531	
November	4.376		17.281	
December	3 658		14 500	
Year	5.325		19.034	

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6 732	4 513	6 582	4.363	27 125	20 563
February	6 814	4 788	6 664	4.638	25 938	20 875
March	6 837	4.665	6 687	4.527	26 094	21 075
April	6 685	4 645	6 535	4.495	25 900	21 344
May	6 441	4.608	6 291	4.458	25 563	19.906
June	6 419	4.543	6 269	4.393	25 469	19.000
July	6 072	4.485	5 922	4.338	23 850	19.031
August	5.701		5 551		21 969	
September	5.236		5 086		21 050	
October	5 430		5 280		21 781	
November	4.925		4.775		21.438	
December	4.254		4 104		20 075	
Year	5.962		5.812		23.771	

New York and St. Louis, cents per pound. London in pounds sterling per long ton.